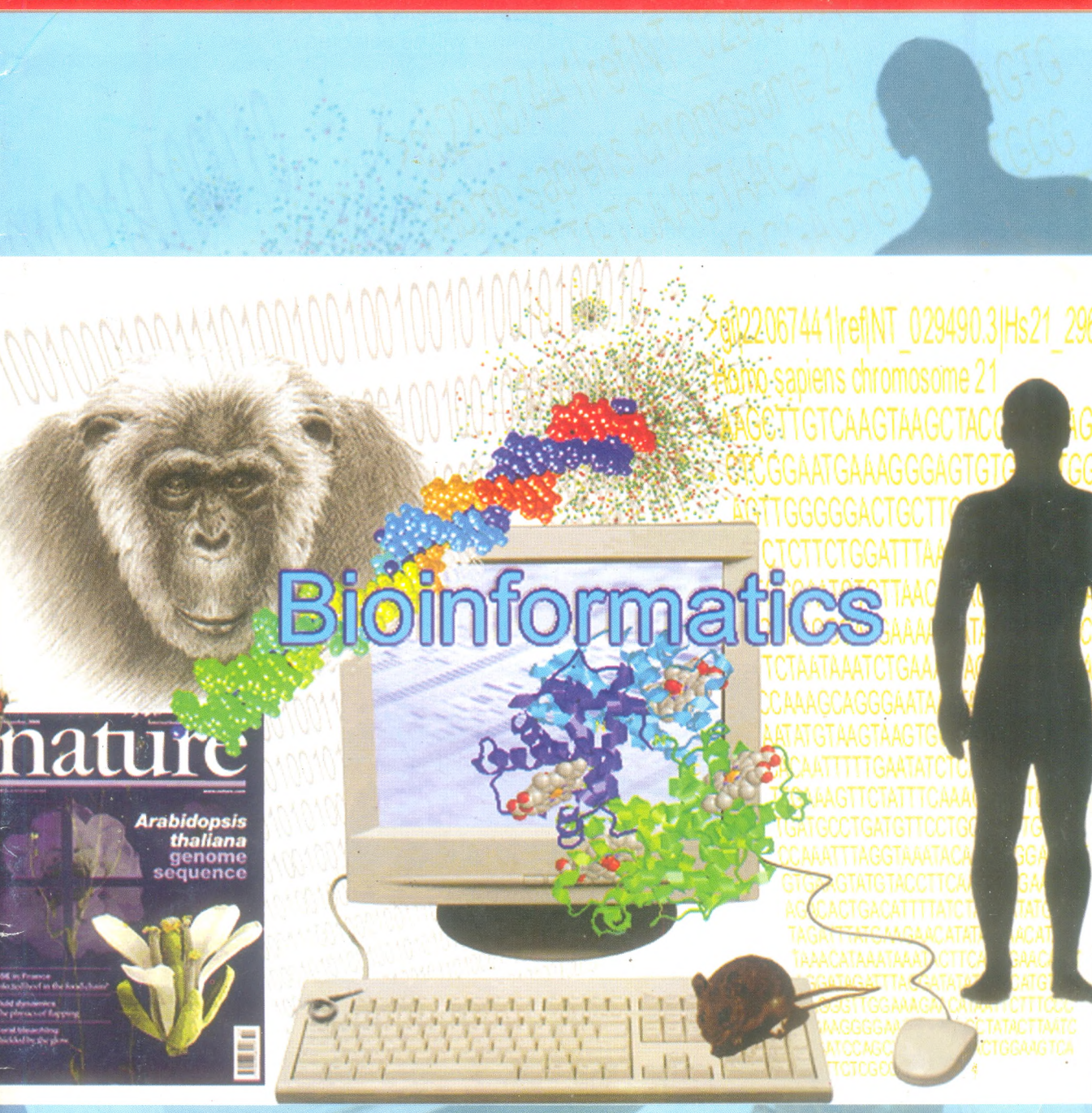
Vol 14. No. 6 June 2011

ISSN 0972 - 8287

SCIENCE INDIA

THE NATIONAL SCIENCE MAGAZINE

Published by
Swadeshi Science Movement



SCIENCE INDIA QUIZ

Send the correct answers to Science India office or to arsmenon@gmail.com/scienceindia2010@gmail.com latest by 20th June, 2011. A science book as prize awaits you. If there are more than one correct entries, the winner will be selected by draw of lots

- Editor

SCIENCE INDIA QUIZ NO. 19

1. Filament of an electrical bulb is made of -------
2. Nitrogen in laboratory is prepared by heating -------
3. Potato is the modified form (outgrowth) of -------
4. Red blood corpuscles are formed in the -------
5. Petroleum consists of a complex mixture of -------
6. Leukemia is a disease of the -------
7. Bacteria in the soil that can absorb nitrogen
8. Plant that grows quickest
9. The Vitamin involved in calcium and phosphorous metabolism. Its deficiency impairs bone-growth and causes rickets. Fish liver oils are a rich source of this Vitamin
10. This famous scientist said, 'Knowledge is Power'

Answers to Quiz No. 18

1. Depends on the distance between the person and the mirror 2. Aluminium 3. Sclerenchyma 4. 5-6 litres 5. Sodium chloride 6. Eyes 7. Acceleration 8. Ballistics 9. Cacophobia 10. Data

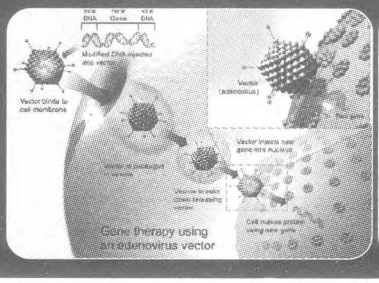
The winner is Master Jijo Alexander, Bhavans Varuna Vidyalaya, Cochin
CONGRATULATIONS !!!

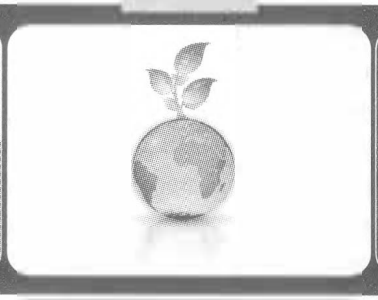
CONTENTS

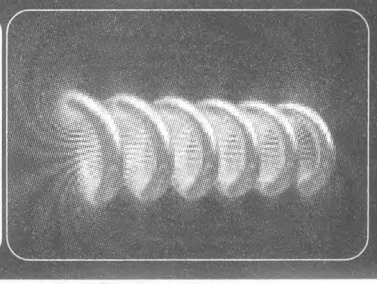
4 Bioinformatics

16 Are we serious about conserving biodiversity?

20 The truth beyond electromagnetism*







Dr. S. Krishnaswamy - A veteran of documentary movemnet in India ---------- 24

Trees and rain : Antibiotics of the earch ------ 33

Science of the Month ---------- 39

Influence of star's movement on its life ------ 44

Book of the month ---------- 49

SCIENCE INDIA
THE NATIONAL SCIENCE MAGAZINE

SUBSCRIPTION INFORMATION

Science India is a national monthly Science Magazine. 12 issues are published in one year, comprising of one volume. For subscriptions, please fill the form below and mail to Science India.

I/We wish to subscribe Science India for one year/ ..... years. The subscription fee of ₹..... is sent herewith as demand draft (payable at Ernakulam), drawn in favour of Science India

WE ACCEPT ONLY DD/MONEY ORDER

DD/MO (in favour of Science India, Ernakulam)

Date..... Number.....

Bank.....

Name.....

Mailing Address.....

.....

.....

.....*Pin*.....

Telephone.....

E Mail.....

Date: *Signature*

SUBSCRIPTION RATE

INDIVIDUALS	
Single Issue:	₹ 20
Annual Subscription:	₹ 200
Three year Subscription:	₹ 500
INSTITUTIONS	
Annual Subscription (Schools):	₹ 600
Three year Subscription (Schools):	₹ 1500
Annual Subscription (Colleges, Other Institutes etc.):	₹ 1000
Three year Subscription (Colleges, Other Institutes etc.):	₹ 2500
FOREIGN COUNTRIES	
Single Issue:	U.S. $ 10
Annual Subscription:	U.S. $ 80
Three year Subscription:	U.S. $ 200

Mail to:

SCIENCE INDIA
Sastra Bhavan, B4, 4th Floor, Mather Square
Town Railway Station Road, Kochi - 682 018
Ph: 0484 - 2393242, 2393256 Fax: 2393256
E-mail: scienceindia2010@gmail.com
www.scienceindia.in

PATRONS

Prof. M.G.K Menon, Former Director,TIFR, New Delhi
Prof. V.N. Rajasekharan Pillai, V.C., IGNOU, New Delhi

ADVISORY BOARD MEMBERS

Dr. R.A. Mashelkar, Former DG, CSIR, New Delhi
Dr. Vijay Bhatkar, Chairman, Multiversity, Pune
Dr. C.G. Ramachandran Nair, Thiruvananthapuram
Prof. S.D. Sapre, N.I.T, Bhopal
Prof. V.P.N. Nampoori, CUSAT, Kochi
Dr. K.I. Vasu, Vijnana Bharathi, Bangalore
Dr. K. Ravindran, Former Director, CIFT, Kochi
Dr. M.N. Sreedharan Nair, Thiruvananthapuram
Prof. A. Krishnamoorthy, CUSAT, Kochi

CHIEF EDITOR

Dr. A.R.S. Menon, CIFT, Kochi
arsmenon@gmail.com

ASSOCIATE EDITOR

Dr. Jayasree Sukumaran
Dy. Director (Retd.), Collegiate Education, Kerala

MANAGING EDITOR

Ar. P.A. Vivekananda Pai, Architect, Kochi

EXECUTIVE EDITOR

Dr. K.K.C. Nair, Scientist-in-Charge (Retd.), NIO, Kochi

EDITOR

Shri Smart Kundassery, SSRI, Kochi

OVERSEAS EDITORS

Dr. M. Santhosh
Faculty of Science, Kochi University, Kochi, Japan
Dr. S.S. Iyer
Department of Physics and Astronomy
University of Calgary, Canada

OFFICE IN CHARGE: Ramesan and Prejesh

Printed and Published by: A. Jayakumar
and owned by Swadeshi Science Movement (Kerala)
B4, Mather Square,Town Railway Station Road
Kochi - 682 018, Kerala, India
Published from Ernakulam

visit:www.ssmkerala.org

Printed at: Niseema Printers, Cochin

The views expressed by the authors are not necessarily those of the Swadeshi Science Movement

Editorial

Bioinformatics is the application of computer technology to the management of biological information. Computers are used to gather, store, analyze and integrate biological and genetic information which can then be applied to gene-based drug discovery and development. The need for Bioinformatics capabilities has been precipitated by the explosion of publicly available genomic information resulting from the Human Genome Project.

The science of bioinformatics or computational biology is increasingly being used to improve the quality of life as we know it. Bioinformatics has developed out of the need to understand the code of life, DNA. Massive DNA sequencing projects have evolved and added in the growth of the science of bioinformatics. DNA, the basic molecule of life directly controls the fundamental biology of life. It codes for genes which code for proteins which determine the biological makeup of humans or any living organism. It is variations and errors in the genomic DNA which ultimately define the likelihood of developing diseases or resistance to these same disorders.

The ultimate goal of bioinformatics is to uncover the wealth of biological information hidden in the mass of sequence, structure, literature and other biological data and obtain a clearer insight into the fundamental biology of organisms and to use this information to enhance the standard of life for mankind.

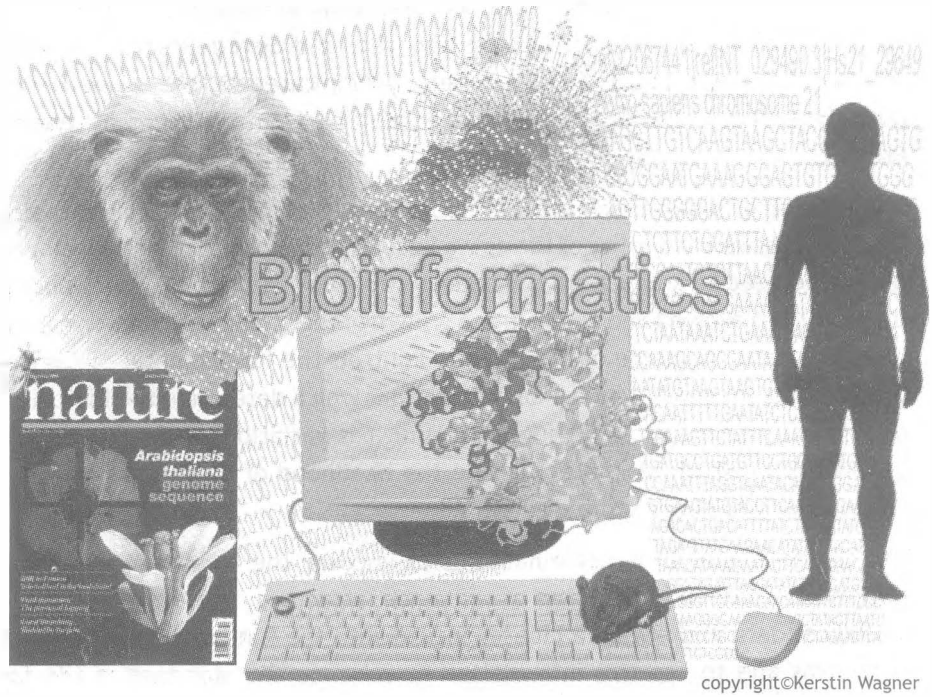
It is being used now and in the foreseable future in the areas of molecular medicine to help produce better and more customised medicines to prevent or cure diseases, it has environmental benefits in identifying waste cleanup bacteria and in agriculture it can be used for producing high yield low maintenance crops. A special article on 'Bioinformatics' is the Cover Story of this issue of Science India.

Team Science India

BIOINFORMATICS

Dr. S. Jayasree

The science of bioinformatics or computational biology is increasingly being used to improve the quality of life. The term 'bioinformatics' was coined by Paulien Hogeweg in 1979 for the study of informatic processes in biotic systems. Its primary use since at least the late 1980s has been in genomics and genetics, particularly in those areas of genomics involving large-scale DNA sequencing. Bioinformatics is an inter-disciplinary research area that is the interface between the biological and computational sciences. The ultimate goals of bioinformatics is to uncover the wealth of biological information hidden in the mass of sequence, structure, literature and other biological data and obtain a clearer insight into the fundamental biology of organisms and to use this information to enhance the standard of life of mankind.



copyright©Kerstin Wagner

Bioinformatics has developed out of the need to understand the code of life, DNA. Massive DNA sequencing projects have evolved and added in the growth of the science of bioinformatics. DNA, the basic molecule of life directly controls the fundamental biology of life. It codes for genes which code for proteins which in

turn determine the biological makeup of humans or any living organism. It is variations and errors in the genomic DNA which ultimately define the likelihood of developing diseases or resistance to these same disorders.

Bioinformatics is the application of computer technology to the management and analysis of biological data. The result is that computers are being used to gather, store, analyse and merge biological data. This new knowledge could have profound impacts on fields as varied as human health, agriculture, the environment, energy and biotechnology.

Why is bioinformatics important?

The greatest challenge facing the molecular biology community today is to make sense of the wealth of data that has been produced by the genome sequencing projects. Traditionally, molecular biology research was carried out entirely at the experimental laboratory bench but the huge increase in the scale of data being produced in this genomic era has seen a need to incorporate computers into this research process.

The first challenge facing the bioinformatics community today is the intelligent and efficient storage of this mass of data. It is then their responsibility to provide easy and reliable access to this data. The data itself is meaningless before analysis and the sheer volume present makes it impossible for even a trained biologist to begin to interpret it manually. Therefore, incisive computer tools must be developed to allow the extraction of meaningful biological information.

Sequence generation, and its subsequent storage, interpretation and analysis are entirely computer dependent tasks. However, the molecular biology of an organism is a very complex issue with research being carried out at different levels including the genome, proteome, transcriptome and metabalome levels. Following on from the explosion in volume of genomic data, similar increase in data have been observed in the fields of proteomics, transcriptomics and metabalomics.

The first challenge facing the bioinformatics community today is the intelligent and efficient storage of this mass of data. It is then their responsibility to provide easy and reliable access to this data. The data itself is meaningless before analysis and the sheer volume present makes it impossible for even a trained biologist to begin to interpret it manually. Therefore, incisive computer tools must be developed to allow the extraction of meaningful biological information.

There are three central biological processes around which bioinformatics tools must be developed:

- DNA sequence determines protein sequence
- Protein sequence determines protein structure
- Protein structure determines protein function

The integration of information learned about these key biological processes should allow us to achieve the long term goal of the complete understanding of the biology of organisms.

Aims of Bioinformatics

The aims of bioinformatics are basically three-fold. They are:

- Organization of data in such a way that it allows researchers to access existing information and to submit new entries as they are produced. While data-creation is an essential task, the information stored in these databases is useless unless analysed. Thus the purpose of bioinformatics extends well beyond mere volume control.
- To develop tools and resources that help in the analysis of data. For example, having sequenced a particular protein, it is with previously characterized sequences. This requires more than just a straightforward database search. As such, programmes such as FASTA and PSI-BLAST consider much what constitutes a biologically significant resemblance. Development of such resources requires extensive knowledge of computational theory, as well as a thorough understanding of biology.
- Use of these tools to analyse the individual systems in detail, and frequently compare them with few that are related.

Three levels of bioinformatics

1. Analysis of a single gene (protein) sequence, such as:
   - Similarity with other known genes
   - Phylogenetic trees and evolutionary relationships
   - Identification of well-defined domains in the sequence
   - Sequence features (physical properties, binding sites, modification sites)
   - Prediction of subcellular localization
   - Prediction of secondary and tertiary structure
2. Analysis of complete genomes, such as:
   - Which gene families are present and which are missing?
   - Location of genes on the chromosomes, correlation with function or evolution
   - Expansion/duplication of gene families
   - Presence or absence of biochemical pathways
   - Identification of "missing" enzymes
   - Large-scale events in the evolution of organisms
3. Analysis of genes and genomes with respect to functional data, such as:
   - Expression analysis; microarray data; mRNA concentration measurements

- Proteomics; protein concentration measurements, covalent modifications
- Comparison and analysis of biochemical pathways
- Deletion or mutant genotypes vs. phenotypes
- Identification of essential genes, or genes involved in specific processes

Biological databases

Biological databases are archives of consistent data that are stored in a uniform and efficient manner. These databases contain data from a broad spectrum of molecular biology areas. Primary or archived databases contain information and annotation of DNA and protein sequences, DNA and protein structures and DNA and protein expression profiles.

Secondary or derived databases are so called because they contain the results of analysis on the primary resources including information on sequence patterns or motifs, variants and mutations and evolutionary relationships. Information from the literature is contained in bibliographic databases, such as Medline.

It is essential that these databases are easily accessible and that an intuitive query system is provided to allow researchers to obtain very specific information on a particular biological subject. The data should be provided in a clear, consistent manner with some visualisation tools to aid biological interpretation.

Biological databases are archives of consistent data that are stored in a uniform and efficient manner. These databases contain data from a broad spectrum of molecular biology areas.

Specialist databases for particular subjects have been set-up, for example EMBL database for nucleotide sequence data, Swiss-Prot, protein database and PDB - a 3D protein structure database.

Scientists also need to be able to integrate the information obtained from the underlying heterogeneous databases in a sensible manner in order to be able to get a clear overview of their biological subject. SRS (Sequence Retrieval System) is a powerful, querying tool provided by the EBI that links information from more than 150 heterogeneous resources.

Bioinformatics tools

Bioinformatic tools are software programmes that are designed to carry out this analysis step. Factors that must be taken into consideration when designing these tools are:

- The end user (the biologist) may not be a frequent user of computer technology
- These software tools must be made available over the internet given the global distribution of the scientific research community

The EBI provides a wide range of biological data analysis tools that fall into the following four major categories:

- Similarity Searching Tools
- Protein Function Analysis
- Structural Analysis
- Sequence Analysis

Similarity Searching Tools: Homologous sequences are sequences that are related by divergence from a common ancestor. Thus the degree of similarity between two sequences can be measured while their homology is a case of being either true of false. This set of tools can be used to identify similarities between novel query sequences of unknown structure and function and database sequences whose structure and function have been elucidated.

Protein Function Analysis: This group of programmes allows you to compare your protein sequence to the secondary (or derived) protein databases that contain information on motifs, signatures and protein domains. Highly significant hits against these different pattern databases allow you to approximate the biochemical function of your query protein.

Structural Analysis: This set of tools allows you to compare structures with the known structure databases. The function of a protein is more directly a consequence of its structure rather than its sequence with structural homologs tending to share functions. The determination of a protein's 2D/3D structure is crucial in the study of its function.

Sequence Analysis: This set of tools allows you to carry out further, more detailed analysis on your query sequence including evolutionary analysis, identification of mutations, hydropathy regions, CpG islands and compositional biases. The identification of these and other biological properties are all clues that aid the search to elucidate the specific function of your sequence.

Bioinformatics tools

Similarity Searching Tools

- BLAST - Alignment of two protein/ Nucleotide sequences (NCBI, USA)
- FASTA- Alignment of two protein/ Nucleotide sequences (NCBI, USA)
- CLUSTALW- Multiple sequence alignment Tool (EBI, UK)

DNA Sequence Analysis Tools

- **Webcutter** (Restriction analysis)
- **RepeatMasker** (Search interspersed repeats and low complexity sequences)
- **dnadot** (Find regions of similarity in two sequences and repeats within a single sequence at Colorado State University, USA)

Find Genes

- **ORF Finder** (at NCBI)
- **GeneMark** (Species-specific search for genes cfr. WebGeneMark at EBI, UK)

- **GRAIL** (Exon recognition, USA)
- **Gene feature** (Exon recognition, Promoter and Transcription Factor Binding Site Prediction, Open Reading Frame Identification at Baylor College of Medicine (USA)

Protein Function Assignment

- **ScanProsite** (Search a protein sequence against PROSITE pattern database at ExPASy, CH)
- **PROSCAN** (Search a protein sequence against PROSITE pattern database allowing mismatches at PBIL, Lyon, France)
- **PFSCAN** (Search protein against different profile databases at ISREC; also searches PROSITE and Pfam patterns)
- **BLOCKS Search** (Search a protein against BLOCKS database; also searches PRINTS)

Search, computation and analysis of pathways

- **KEGG** (Search and computation tools at KEGG pathway database, Kyoto, Japan)

Protein sequence and Structure

- **ProtParam** (Calculate aa comp, MW, pI, extinction coefficient at ExPASy, CH)
- **Hydropathy plots** (At Pensylvania State University, Department of Biochemistry and Molecular Biology)
- **SignalP** (Prediction of peptide signal sequence at CBS, Denmark)

Predict Secondary Structure

- **TMHMM** (Prediction of transmembrane helices in proteins at CBS, Denmark)

Analyse and Model 3D Structure

- **Swiss-Pdb Viewer (Deep View)** (Free offline 3D viewing and analysis application, tightly linked to Swiss-Model Tutorial)
- **RasMol** (Free offline 3D viewer)

3D Homology Modelling

- **Swiss-Model** (Automated protein modeling server at ExPASy, Switzerland)
- **CPH models** (Structure prediction by comparative homology modeling at CBS, Denmark)

Phylogenetic Analysis

- **Entrez-PopSet** (Search set of DNA sequences from populations of related individuals/organisms at NCBI)
- **TaxPlot** (3-way comparisons of genomes based on encoded proteins at NCBI)

Species Specific Databases

- **OMIM** - Online Mendelian Inheritance in Man
- **GENATLAS** - Human genes atlas
- **GeneClinics** - Medical genetics knowledge base

Application of Bioinformatics

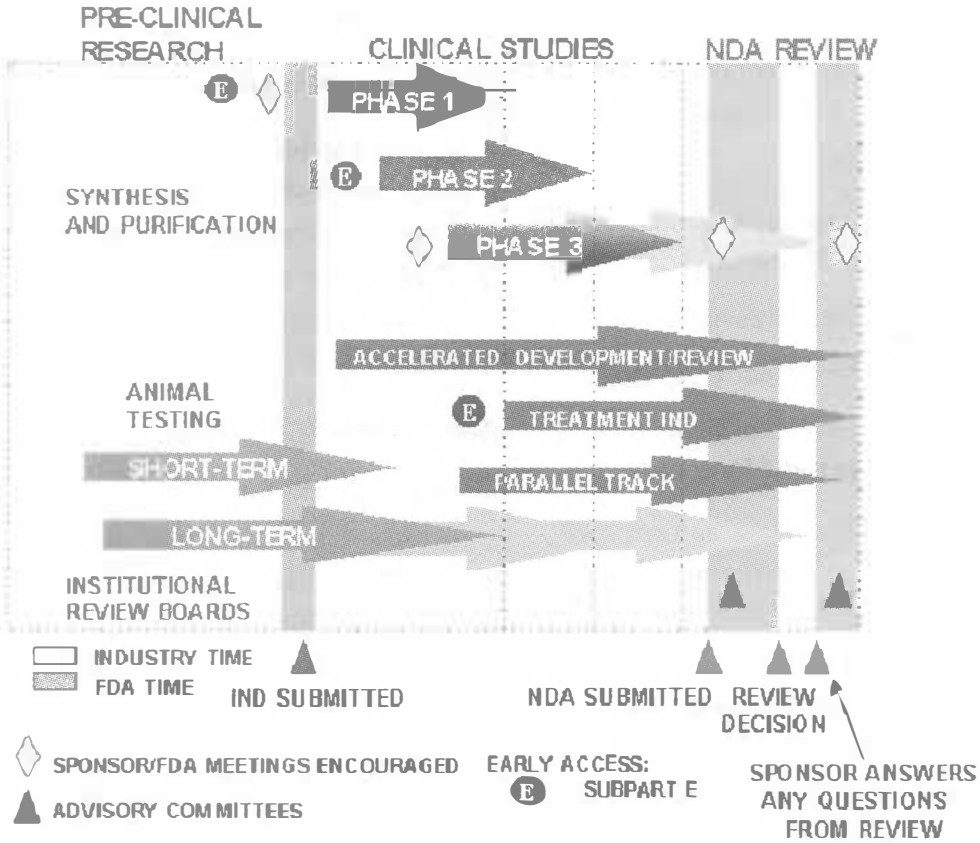
Bioinformatics is the use of IT in biotechnology for the data storage, data

warehousing and analyzing the DNA sequences. In Bioinformatics knowledge of many branches are required like biology, mathematics, computer science, laws of Physics and Chemistry, and ofcourse sound knowledge of IT to analyze biotech data. Bioinformatics is not limited to the computing data, but in reality it can be used to solve many biological problems and find out how living things works.

It is the comprehensive application of mathematics (e.g. probability and statistics), science (biochemistry), and a core set of problem-solving methods (computer algorithms) to the understanding of living systems.

Molecular medicine

The human genome will have profound effects on the fields of biomedical research and clinical medicine. Every disease has a genetic component. This may be inherited (as is the case with an estimated 3000-4000 hereditary disease including Cystic Fibrosis and Huntington's disease) or a result of the body's response to an environmental stress which causes alterations in the genome (e.g. cancers, heart disease, diabetes). The completion of the human genome means that we can search for the genes directly associated with different diseases and begin to understand the molecular basis of these diseases more clearly. This new knowledge



of the molecular mechanisms of disease will enable better treatments, cures and even preventative tests to be developed.

Personalized medicine

Clinical medicine will become more personalized with the development of the field of pharmacogenomics. This is the study of how an individual's genetic inheritance affects the body's response to drugs. At present, some drugs fail to make it to the market because a small percentage of the clinical patient population show adverse affects to a drug due to sequence variants in their DNA. As a result, potentially life saving drugs never makes it to the marketplace. Today, doctors have to use trial and error to find the best drug to treat a particular patient as those with the same clinical symptoms can show a wide range of responses to the same treatment. In the future, doctors will be able to analyze a patient's genetic profile and prescribe the best available drug therapy and dosage from the beginning.

Preventative medicine

With the specific details of the genetic mechanisms of diseases being unraveled, the development of diagnostic tests to measure a person's susceptibility to different diseases may become a distinct reality. Preventative actions such as change of lifestyle or having treatment at the earliest possible stages when they are more likely to be successful, could result in huge advances in our struggle to conquer disease.

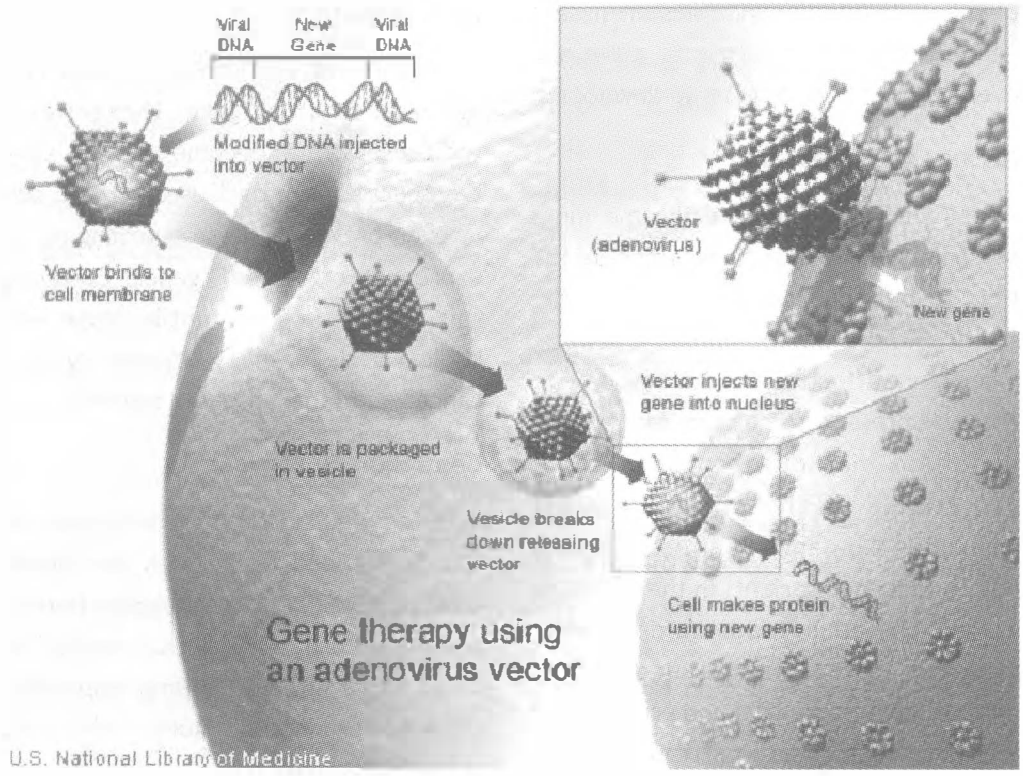
Gene therapy

In the not too distant future, the potential for using genes themselves to treat disease may become a reality. Gene therapy is the approach used to treat, cure or even prevent disease by changing the expression of person's genes. Currently, this field is in its infantile stage with clinical trials for many different types of cancer and other diseases ongoing.

Gene therapy approaches

Effective transfer of genetic material into human cells is perhaps the biggest challenge in Gene Therapy. A gene transfer agent has to be safe, introduce its DNA cargo into a sufficiently large population of cells to produce a biological effect and mediate expression of the desired gene for a sustained period of time. Identifying a gene transfer tool that meets all of these criteria has proven to be a difficult task.

Gene Therapy is normally used in diseases where the cells of a particular organ or system cannot function correctly due to the fact that they do not have an essential protein that is required to perform a specific task. In order to replace the malfunctioning protein, a gene transfer vector (such as a disabled adenovirus in the diagram below) is modified so that it contains the gene that encodes for this protein. The modified vector is then given to the patient where it enters the affected cells. The gene transfer vector then transfers the therapeutic gene to the cell and the cell's own machinery turns the therapeutic gene


Viral DNA
New Gene
Viral DNA
Modified DNA injected into vector
Vector binds to cell membrane
Vector (adenovirus)
New gene
Vector injects new gene into nucleus
Vector is packaged in vesicle
Vesicle breaks down releasing vector
Cell makes protein using new gene
Gene therapy using an adenovirus vector
U.S. National Library of Medicine

into correct version of the protein, which in essence fixes the malfunctioning cell.

Drug development

At present all drugs in the market target only about 500 proteins. With an improved understanding of disease mechanisms and using computational tools to identify and validate new drug targets, more specific medicines that act on the cause, not merely the symptoms, of the disease can be developed. These highly specific drugs promise to have fewer side effects than many of today's medicines.

An outline of the drug development process

Drug development involves a complex, FDA-regulated process of clinical trials.

Microbial genome applications

Microorganisms are ubiquitous, that is they are found everywhere. They have been found surviving and thriving in extremes of heat, cold, radiation, salt, acidity and pressure. They are present in the environment, our bodies, the air, food and water. Traditionally, use has been made of a variety of microbial properties in baking, brewing and food industries. The arrival of the complete genome sequences and their potential to provide a greater insight into the microbial world and its capacities could have broad and far reaching implications for environment, health, energy and industrial applications. For these reasons, in 1994, the US Department of Energy (DOE) initiated the MGP (Microbial Genome Project) to

sequence genomes of bacteria useful in energy production, environmental cleanup, industrial processing and toxic waste reduction. By studying the genetic material of these organisms, scientists begin to understand these microbes at a very fundamental level and isolate the genes that give them their unique abilities to survive under extreme conditions.

Waste cleanup

Deinococcus radiodurans is known as the world's toughest bacteria and it is the most radiation resistant organism known. Scientists are interested in this organism because of its potential usefulness in cleaning up waste sites that contain radiation and toxic chemicals.

Climate change studies

Increasing levels of Carbon dioxide emission, mainly through the expanding use of fossil fuels for energy, are thought to contribute to global climate change. Recently, the DOE launched a programme to decrease atmospheric Carbon dioxide levels. One method of doing so is to study the genomes of microbes that use Carbon dioxide as their sole carbon source.

Alternative energy sources

Scientists are studying the genome of the microbe *Chlorobium tepidum* which has an unusual capacity for generating energy from light.

Biotechnology

The dynamic development of bioinformatics enables both planning of biological research and its multi-directed analysis. The application of computer databases and specialized computer programmes is the basis for the development of many contemporary biological disciplines, including molecular genetics. Bioinformatics seems to be the tool necessary to study the structure of genes, their mechanisms of operation, and their cooperation.

Antibiotic resistance

Scientists have been examining the genome of *Enterococcus faecalis* -- a leading cause of bacterial infection among hospital patients. They have discovered a virulence region made up of a number of antibiotic-resistant genes that may contribute to the bacterium's transformation from harmless gut bacteria to a menacing invader. The discovery of the region, known as a pathogenicity island, could provide useful markers for detecting pathogenic strains and help to establish controls to prevent the spread of infection in wards.

Forensic analysis of microbes

Scientists used their genomic tools to help distinguish between the strain of *Bacillus anthryacis* that was used in the summer of 2001 terrorist attack in Florida with that of closely related anthrax strains.

The reality of bio-weapon creation

Scientists have recently built the virus poliomyelitis using entirely artificial means. They did this using genomic data

available on the Internet and materials from a mail-order chemical supply. The research was financed by the US Department of Defense as part of a bio-warfare response programme to prove to the world the reality of bio-weapons. The researchers also hope that their work will discourage officials from ever relaxing programmes of immunisation. This project has been met with very mixed feelings.

Evolutionary studies

The sequencing of genomes from all three domains of life, eukaryota, bacteria and archaea means that evolutionary studies can be performed in a quest to determine the tree of life and the last universal common ancestor.

Crop improvement

Comparative genetics of the plant genomes has shown that the organization of their genes has remained more conserved over evolutionary time than was previously believed. These findings suggest that information obtained from the model crop systems can be used to suggest improvements to other food crops. At present the complete genomes of *Arabidopsis thaliana* (water cress) and *Oryza sativa* (rice) are available.

Insect resistance

Genes from *Bacillus thuringiensis* that can control a number of serious pests have been successfully transferred to cotton, maize and potatoes. This new ability of the plants to resist insect attack means that the amount of insecticides being used can be reduced and hence the nutritional quality of the crops is increased.

Improve nutritional quality

Scientists have recently succeeded in transferring genes into rice to increase levels of Vitamin A, iron and other micronutrients. This work could have a profound impact in reducing occurrences of blindness and anemia caused by deficiencies in Vitamin A and iron respectively. Scientists have inserted a gene from yeast into the tomato, and the result is a plant whose fruit stays longer on the vine and has an extended shelf life.

Development of drought resistance varieties

Progress has been made in developing cereal varieties that have a greater tolerance for soil alkalinity, free aluminum and iron toxicities. These varieties will allow agriculture to succeed in poorer soil areas, thus adding more land to the global production base. Research is also in progress to produce crop varieties capable of tolerating reduced water conditions.

Vetinary science

Sequencing projects of many farm animals including cows, pigs and sheep

are now well under way in the hope that a better understanding of the biology of these organisms will have huge impacts for improving the production and health of livestock and ultimately have benefits for human nutrition.

Comparative studies

Analyzing and comparing the genetic material of different species is an important method for studying the functions of genes, the mechanisms of inherited diseases and species evolution. Bioinformatics tools can be used to make comparisons between the numbers, locations and biochemical functions of genes in different organisms.

Organisms that are suitable for use in experimental research are termed model organisms. They have a number of properties that make them ideal for research purposes including short life span, rapid reproduction, being easy to handle, inexpensive and they can be manipulated at the genetic level.

An example of a human model organism is the mouse. Mouse and human are very closely related (>98%) and for the most part we see a one to one correspondence between genes in the two species. Manipulation of the mouse at the molecular level and genome comparisons between the two species can and is revealing detailed information on the functions of human genes, the evolutionary relationship between the two species and the molecular mechanisms of many human diseases.

References

1. Mclnerney, J. O. (2002) - Bioinformatics in a post-genomics world - the need for an inclusive approach, *The Pharmacogenomics J.* **2:** 207-208.
2. Hogeweg, P. (1978) - Simulating the growth of cellular forms, *Simulation* **31:** 90-96.
3. Hogeweg, P. and Hesper, B. (1978) - Interactive instruction on population interactions, *Comput. Biol. Med.* **8:** 319-327.
4. Sanger F, Air, G.M., Barrell, B.G., Brown, N.L., Coulson, A.R., Fiddes, C.A., Hutchison, C.A., Slocombe, P.M. and Smith, M. (1977) - Nucleotide sequence of bacteriophage phi X174 DNA, *Nature* **265** (5596): 687-695.
5. Baldi, P. and Brunak, S. (2001) - *Bioinformatics: The Machine Learning Approach*, 2nd edition. MIT Press.
6. Barnes, M.R. and Gray, I.C. (2003) - Eds., *Bioinformatics for Geneticists*, 1st edition. Wiley.
7. Baxevanis, A.D. and Ouellette, B.F. (2005) - Eds., *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*, 3rd edition. Wiley.
8. Baxevanis, A.D., Petsko, G.A., Stein, L.D. and Stormo, G.D. (2007) - Eds., *Current Protocols in Bioinformatics*. Wiley.
9. Claverie, J.M. and Notredame, C. (2003) - *Bioinformatics for Dummies*. Wiley.
10. Cristianini, N. and Hahn, M. (2006) - *Introduction to Computational Genomics*, Cambridge University Press.
11. Durbin, R., Eddy, S., Krogh, A.Q. and Mitchison, G. (1998) - *Biological sequence analysis*. Cambridge University Press.

Dr. S. Jayasree
Department of Zoology
Mercy College
Palakkad - 678 006
E Mail: drjayasree9@gmail.com

ARE WE SERIOUS ABOUT CONSERVING BIODIVERSITY?

Dr. Biju Dharmapalan and Dr. P.V. Harinandanan

"The one ongoing process that will take millions of years to correct is the loss of genetic and species diversity by the destruction of natural habitats. This is the folly our descendants are least likely to forgive us".

Edward O. Wilson, *The Diversity of Life*

Biodiversity is losing with every passing year. Crores of rupees have been spent for the conservation of biodiversity. The United Nations proclaimed 2010 as the International Year of Biodiversity, and people all over the world have worked to safeguard this irreplaceable natural wealth and reduce biodiversity loss. This is vital for current and future human well being. What's the use? Are we really concerned about biodiversity loss?

We have to conserve biodiversity as it is the blood of life. Humans can't have a life without biodiversity

The United Nations Convention on Biological Diversity defines biodiversity as "the variability among living organisms including, *inter alia*, terrestrial, marine and other aquatic systems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems".

Why does biodiversity - the diversity of life - matter? Why should we even worry about extinction, when fossil records show that species have always gone extinct naturally over periods of millions of years? Because in our era, the pace of extinction, and its cause, is dramatically different. Now, according to estimates by world-renowned conservation biologists, man's impact on the environment is causing species to vanish at a rate that is hundreds of times faster than the natural rate. 'Nature Serve's' own comprehensive data for North America documents that in the United States alone, more than 500 species are known to be extinct or are missing. And extinction is forever.

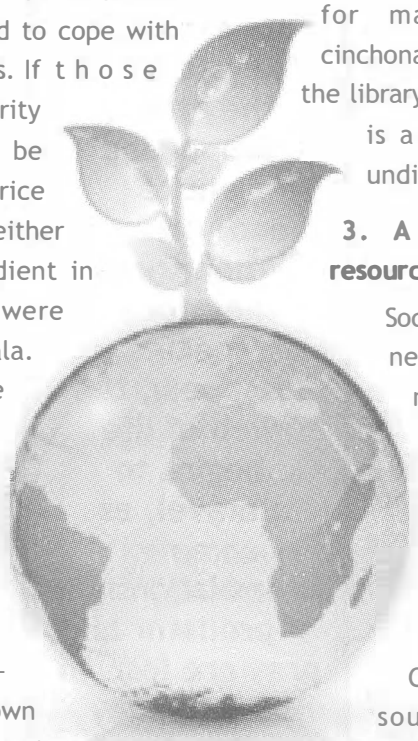
We have to conserve biodiversity as it is the blood of life. Humans can't have a life without biodiversity because of the following factors:

1. Feeding the world

Without biodiversity there will be no agriculture. Farming practices should not jeopardize species survival; improving farmland diversity and reducing the usage

of pesticides and fertiliser are key efforts to save biodiversity. Organic agriculture practices can serve as an example in many areas.

A mere 20 species provide about 90 percent of the world's food! All major food crops, including rice, corn, wheat, and soybeans, depend on the introduction of new strains from the wild to cope with evolving disease and pests. If those strains are lost, the security of our food supply will be threatened. For example, rice varieties which are used either as medicine or as ingredient in medicinal preparations were largely available in Kerala. Though the bulk of the wide variability in medicinal paddy grown in Kerala are lost, some varieties viz., Njavara, Chennellu, Kunjinellu, Erumakkari, Karutha-chembavu, Kavungin-poothala etc. are still grown by farmers. Njavara, the unique medicinal rice variety from Kerala deserves special mention in this regard. Kerala even has scented varieties of rice like Gandhakasala, Jeerakasala, Neycheera, Kothampalanikayama, Pookkulathari, Kayama, Kunjikkayama and Rajakayama. If we can conserve these traditional varieties there is no need to go for transgenic varieties.



2. Cure for diseases

Nature has answer to many of the diseases. The list of wonder drugs originated from wild species includes Aspirin for pain relief (from meadowsweet), Penicillin for antibiotics (from the *Pencillium* fungi), Digitoxin for cardiac treatment (from common foxglove), L-dopa for Parkinson's disease (from velvet bean), Taxol for ovarian cancer (from the Pacific yew), and Quinine for malaria (from yellow cinchona). Like unread books in the library of the universe, nature is a treasure house of yet undiscovered species?

3. A wealth of natural resources

Society derives most of life's necessities - food, clothing, medicine - from just a small number of plants and animals. Thousands of natural products are used routinely by industry to produce everyday goods. Consider just one wild source, the humble seaweeds. Compounds derived from seaweeds are used in plastics, polishes, paints, deodorants, detergents, dyes, fire-extinguishing foams, lubricants, meat preservatives, and chicken feed, to name a few among hundreds of products. By preserving the diversity of life, we act as a trustee for the planet, preserving genetic capital for use by future generations.

4. Life- support for the planet

Ecologists and economists are only beginning to estimate the value of the

services that healthy ecosystems provide to our planet. Bacteria break down organic material, building and fertilizing the soil. Wetlands filter pollutants from drinking water. Trees and plants return oxygen to the air through photosynthesis. Vast South American forests create rainfall on a continental scale, and store carbon as a buffer against global climate change. If it were ever possible for humankind to artificially duplicate these services, the cost would run to trillions of dollars annually.

5. Keystone species

Some species appear to be "keystones in the arch", supporting entire ecosystems. When these keystone species disappear, the web of life begins to unravel, as complex interrelationships of predator and prey are lost. In Silent Valley National park most of the animals are seen near the keystone species like *Cullenia* and Fig trees.

Some species appear to be "keystones in the arch", supporting entire ecosystems. When these keystone species disappear, the web of life begins to unravel, as complex interrelationships of predator and prey are lost. In Silent Valley National park most of the animals are seen near the keystone species like *Cullenia* and Fig trees.

6. Maintaining economy

Many states in India especially those of North eastern region depend solely on natural tourism. Nobody goes to Gangatok to see a shopping mall!

Preserving biodiversity is for our own cause, for the present and for the future. We often forget this and the general attitude of this generation is aptly presented in the advertisement of a popular brand of paint, that goes like this ".....the beauty of your house will stand out ..... It is designed with a unique Dirt Pick Up Resistant (DPUR) property. It prevents dust from settling on the wall surface and thereby retains the initial beauty. It also ensures that any dust settling on the walls can easily be washed away with a light spray of water. Combining this with the anti-algal properties give it the best protection for your walls amongst the other exterior emulsions. Standing the test of time, ... is just perfect for your exterior surfaces! The dust that settles on your walls retains moisture and encourages algae formation reducing the aesthetic value of your home....."

We are even not allowing algae to grow. There was a time people enjoyed the beauty of algae and bryophytes seen on the compound walls after heavy rains. As the generation has changed, so the attitude. A minister from a highly 'literate' state in India recently remarked that development couldn't be stalled simply for the conservation of frogs and snakes. Irrespective of political colour

all parties agree that biodiversity is a hindrance to development. Even the general public attitude is in lieu with this. Nobody wants a paddy field in the heart of the city even if it is a sign of healthy living.

What are the main causes of biodiversity depletion? Even though there are hundreds of reasons the main reasons can be outlined as follows:

1. Cemented foot-paths and courtyard of houses and buildings
2. *Tourism:* In India tourism means development. Construction of multistoried buildings are seen as a sign of prosperity of a region. Take any of hill stations whether it is Gangtok or Ooty you can see the concrete jungles instead of natural vegetation.
3. *Government Institutions:* Many of our elite educational institutions like IITs, IISERs, NITs and many research institutions involved in biodiversity conservation are constructed in biodiversity rich areas. They may be proclaiming that they are involved in restoration work, but the damage they made was beyond rectification.
4. *Pilgrims:* Destruction in the name of God ! No body objects. Take the example of Ganga in Varanasi or the tropical forest at Sabarimala, the destruction to ecosystem is at its maximum.
5. *Indian Railways*: The harm the railways does to the ecosystem is enourmous. The system of toilet followed in Indian railways is ...The plastic bottles and aluminium foils the passengers discard also causes problems to ecosystem especially in regions like Konkan which is a biodiversity rich area.
6. *High rise buildings:* In India high-rise buildings are considered as a symbol of development. Whereas in many developed nations efforts have been taken to preserve their heritage buildings whereas we are concerned with their destruction.

Can we save biodiversity?

No international or national efforts in reality wouldn't be able to save biodiversity. It's the attitude of the people that has to be changed. We have to change ourselves as its is our need. People often underestimate the value of biodiversity and natural resources. See for example; one litre of water now costs ₹ 15, that means thousand liters of water is equivalent to one sovereign of gold. The value of biodiversity is much more than this. So each person should conserve biodiversity in his jurisdiction, that means conserve plants in one's compound itself. All educational institutions should spent atleast one hour per week for the cause of biodiversity. All reforms should emanate from the schools and colleges, as new generations are evolved from there. We don't have time to wait, its too short, we have to start immediately for our children and grandchildren; otherwise our lineage will come to an end.

Dr. Biju Dharmapalan and Dr. P.V. Harinandanan
Department of Plant Biotechnology
Mar Athanasios College for Advanced Studies
(MACFAST)
Tiruvalla - 689 101
E Mail: biju@macfast.org

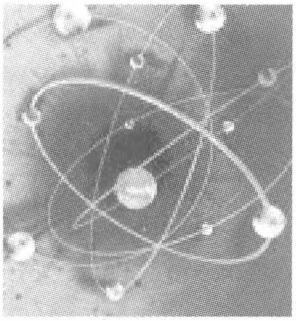
The Truth Beyond Electromagnetism*

"The only thing that remains unchanged in this mortal world is nothing but a change"

- G.B.Shaw

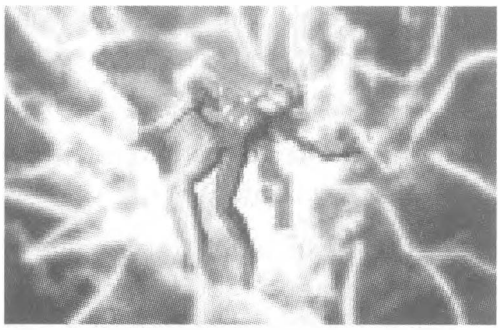
Gaurav Singh

This famous quote by Sir Bernard Shaw,has great relevance in todays world. As he rightly said that a change is the only thing which remains constant, we also find it to be quite true and reprimanding in this vast field of Science & Technology.



Development is the single word that completely describes the base and use of Science. Development never stops and this greed of humans for development gave birth to Science. As quoted by the great science hero of India, Dr. A.P.J. Abdul Kalam: "Today there is nothing more to be discovered in the field of Science and Technology. But what is left is the betterment of what is already discovered".

So my topic for today is based upon Physics, and to be more specific upon Electromagnetism.. This is an assumption of mine which has not yet been discovered and I hope all my readers shall find this interesting.



We all know that, Magnetic Energy produces Electric Energy and vice versa, and this theory has been discovered by the great scientists like Michel Faraday and Sir Hans Oersted. Through their experiments they have showed the way Magnetic Energy produces Electric Energy and vice versa, but neither of them where able to prove how it happens. They didn't knew the reason behind and it is still left undiscovered.

I dealt upon it in my usual Physics classes in school and it left me puzzled. I have a mad love for the subject and this gave way for me to find it.

This was how I thought of and prepared this theory of mine which completely describes: "Why and how electricity produces magnetism and vice versa".

So, before I begin, there is a note for my readers: I am just a class 10 student, so I would love, if all my readers could

* Here is a new idea by a High School Student - Editor

put their views and comments on this theory which would help me add perfection to it.

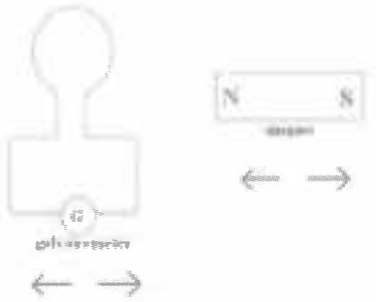
My Theory No. 1.

Question - Why and how does Magnetic Energy produces Electric Energy?

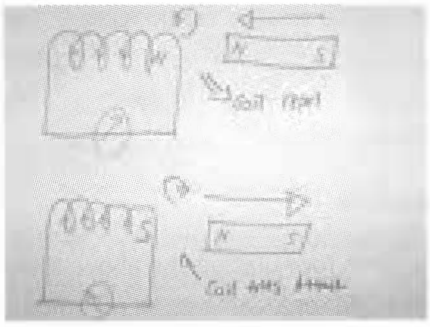
Ans) Assumption - Electrons contains polarity (magnetic) i.e. each electron contains a north or south pole.

Materials Required - A solenoid and a natural magnet.

Process - The magnet is brought near the solenoid for a few seconds and then is again pushed back to is original position.



Observation 1- It is observed that whenever the magnet is brought near the solenoid an emf is generated which travels through the coil of the solenoid causing a deflection in the galvanometer attached to the coil.



Observation 2- When the magnet is moved away from the solenoid there is again a deflction in the galvanometer but this time the deflection is in the opposite direction.

Explanation - Now I explain Observation (1) on the basis of my previous assumption.

I state that, whenever the magnet is brought near the solenoid, the electrons which is of the opposite polarity to the front part of the magnet is attracted towards the magnet whereas, the electrons of the same polarity is repelled backwards. Therefore this flow of electrons around the coil, due to attraction or repulsion by the magnet causes the deflection in the galvanometer and hence current is produced.

On the other hand, in Observation (2) when the magnet is pulled back to its original position the attraction force of the magnet that was attracting or repelling the electrons is no more there, and hence the electrons tend to get back to its original configuration and thus flows back to the original position, thus again causing the deflection in the galvanometer but this time in the opposite direction.

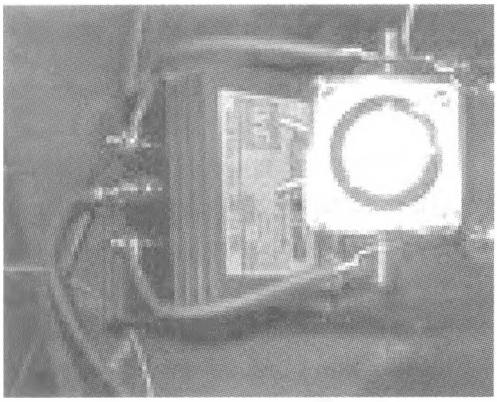
Conclusion - Thus, from my above experiment and explanation I conclude that this way Magnetic energy produces Electric energy

My Theory No. 2.

Question - Why and how does Electric Energy produces Magnetic Energy ?

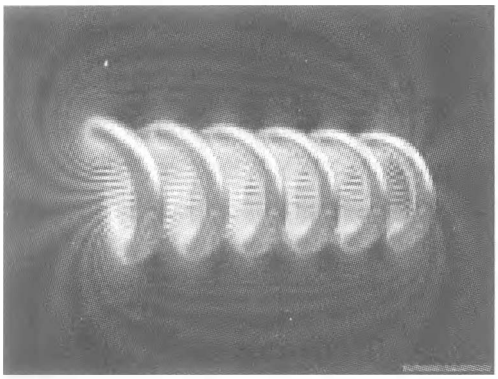
Ans) Assumption - Electrons contains polarity (magnetic) i.e. each electron contains a north or south pole.

Materials Required - A solenoid connected to a battery.



Process - The battery is switched on and the current is allowed to flow through the solenoid.

Observation - It is observed that whenever current is allowed to flow through the solenoid, it behaves like a magnet.



Explanation - Now I explain it on the basis of my above mentioned assumption. I state that, whenever electricity flows through the solenoid, the electrons gets activated due to them as also possessing a particular polarity (according to my assumption). Thus the electrons having a north polarity is concentrated on one side of the solenoid, and the electrons having a south polarity is concentrated on the other side. Hence as two respective poles are generated in the solenoid, it behaves like a magnet.

Affecting Factors

1) Only metals allow a passage of electric current through them, whereas non metals do not.

2) Metals contains the free electrons which are easy to skeet from one point to the other. Thus it helps in proper acquiring of polarity. But in case of nonmetals it does not happen due to the non availability of free electrons. Therefore only metals behaves as a magnet on the passage of electricity.

Conclusion - Thus, from my above experiment and explanation I conclude that this way Electric energy produces Magnetic energy

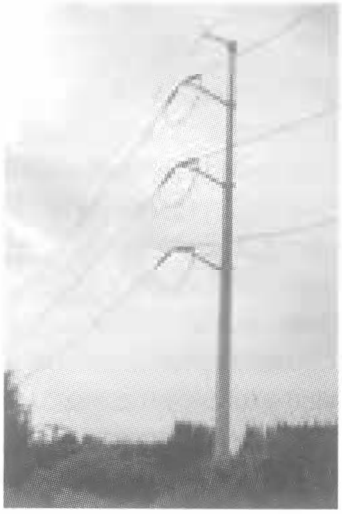
So, this theory tells us about the mechanism of what is happening inside the system, when it produces magnetic energy under the effect of electric energy and vice versa. The undescovered truth about this chapter of electromagnetism is tried to be proved by this theory of mine, and with this assumption I have tried to make a step ahead for the better understanding of the subject Electromagentism.

A New Idea

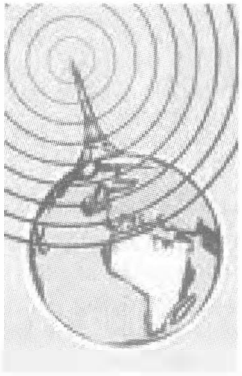
As I was formulating the above theory of mine, an idea came in to my mind. It

was something that could have changed the complete process of electricity transmission, and in turn could have saved crores of rupees.

So, as we know, the electricity produced is transmitted through wires to the Main Station. From the Main Station, electricity again travels through wires to enter the Main Sub Station. Here electricity is Stepped Up and is again transmitted by wires to the Grid Sub Station. From the Grid Station electricity is transmitted to local sub station and then to our homes.



In this complete process about 30% of the total production is lost. So for this problem I thought of an idea.



I thought that if we could convert the electricity into radio-active waves at the point of production and then have receivers at each house which could convert these radio waves back to electric waves and supply to the appliances, then the transmission loss through wires could completely be nullified. And moreover the problem of load-shedding could totally be

stopped. So this idea could not only benefit the people but could also save crores of rupees lost in the process of transmission through wires. Presently I am working on this Idea of mine and I am sure to succeed in making something like this someday in life or other... and I am not going to give up without succeeding in this invention of mine....

Gaurav Singh
Class -10, M.P. Birla School
KOLKATA, West Bengal
E Mail: gaurav26guns@gmail.com

DR. S. KRISHNASWAMY

A veteran of documentary movement in India

Documentary film maker, producer, director and writer Padmashri Dr. S. Krishnaswamy has produced a series of remarkable educational and science films over the past five decades. After studying film and television at Columbia University, New York, he collaborated with Prof. Erik Barnouw and wrote the acclaimed 'Indian Film' (Columbia University Press 1963 & Oxford University Press 1980). Soon after, he founded Krishnaswamy Associates in 1964. In a career spanning 45 years he has made over 400 short films. He has addressed several international conferences around the globe and has held several honorary positions in international film festivals. In 1974, he launched his ambitious film "Indus Valley to Indira Gandhi" and Warner Bros acquired it for worldwide distribution. To celebrate the Golden Jubilee of Indian independence, he made "India 5555" - a documentary on 5 millennia of civilizational values, 5 centuries of recent history, 5 decades of democracy, and 5 years of a new economic policy. It was chosen by the White House and screened for President Bill Clinton who was preparing for his visit to India. In 2008, Doordarshan (National Network) telecast his 18-episode TV Serial, titled "Indian Imprints", on the cultural impact of India on South-East Asia over 2000 years. Based on intensive research in collaboration with his wife, Dr. Mohana Krishnaswamy, he filmed at over 100 locations, in Indonesia, Thailand, Cambodia, Laos and Vietnam, Indian Imprints is widely acclaimed as a creative and historical landmark.

He has won four National Awards for his short films, and many prestigious international awards. In 2005, he received the coveted "Life Time Achievement Award" conferred by the US International Film & Video Festival, Los Angeles, and became the first Afro-Asian recipient of this honour in 40 years. Er Anuj Sinha, Director, Vigyan Prasar and Consultant, Department of Science & Technology, Govt. of India interacted with Dr. S. Krishnaswamy on his contribution in documentary making, challenges in science communication through electronic media, and other developmental aspects. Here are the excerpts of the interaction.

Er Anuj Sinha: You have worked in science outreach extensively. What has been your motivation and do you feel satisfied with the change in the attitude of the common man?

Dr. S. Krishnaswamy: My first experience with science outreach was in the late 1960s. Mr. Umesh Rao, legendary Art Director of J Walter Thomson, and creator of Air India's Maharaja Mascot once said "Krishnaswamy has green fingers with agricultural films". We made promotional films, educational films and training films related to modern agriculture - hybrid seeds, use of fertilizers, etc. Several thousands of 35-mm prints were made supporting different brands of agricultural input products distributed throughout the country. I took whirlwind tours of villages in South India to study the impact of these films. It was most revealing and immensely satisfying to realize that we were among the instruments of change in the green revolution. Madras Fertilizers Ltd., which, at that point of time was the largest fertilizer manufacturing company,

found that their product was more identified with the "Puppet Character" that we had created in our ad-films and documentaries, than with the name of their company. Hence, they adopted the puppet as their monogram and the name of the Puppet character, "Vijay" as the brand name of their product itself. We made a film on 'technology-transfer from the Lab to the Industry', for CSIR, some 25 years ago. We produced over 50 programmes on Home Science, anchored by my daughter Lata, with the cooperation of the Avinasalingam Home Science College, Coimbatore. These programmes were so popular and successful that we derived a great sense of satisfaction. We have dabbled in medical education films, engineering education films and a whole spectrum of science education for the classroom or for in-house training of specific industries. Our film on how the Bahai Temple in Delhi was built, filmed from a 'building technology' point of view, for Larsen & Toubro, was ranked as the best film on Construction Technology at an International Conference of Builders. The colleges and training institutions which have used these different films have given excellent feedback on their popularity with their students. The most recent and highly satisfying science serial in Tamil aimed at the teenage audience is 'Ariviyal Aruvi' (loosely translated as "Shower of Science"), directed by Lata and produced by Dr. Mohana. A state-level conference and seminar in which teenagers from all over Tamil Nadu participated exclusively to discuss this serial, produced immensely gratifying results by way of enthusiasm around the serial.

Dr. Krishnaswamy receiving 'Padmashri'

A S: How do you see the emerging future of TV as a medium for building interest in science among the audience? What complementary efforts are required to make it more effective?

S K: Television as a medium is neutral. It is part of societal responsibility to ensure that it is used productively. Woody Allen said, "Hollywood has invented a unique method of garbage disposal. They simply convert them to television serials". The problem is that with globalization, this trend has been imported worldwide and India produces as much garbage as anybody else, for television. It remains to be seen whether this greatest challenge for civilization will be successfully met with wisdom. As a neutral tool, television is capable of imparting science as well as spirituality by those who handle the medium with knowledge and wisdom. The

complementary effort required is to ensure that the presentation and packaging of science is exciting, so that it can compete for the attention of the young audience with ephemeral and irrelevant programmes with titillating content.

A S: You have introduced a range of innovations on regional and national TV. Please share some of your experiences with our readers.

S K: Innovations are mainly of three kinds - the themes tackled, the methodology employed and the technology employed. In terms of the themes, during the first decade of my career, I found that the release of documentary films in India was so totally dependent on the Films Division, Govt. of India, which had monopolised the 20-minute slot given for non-fiction films in the cinemas. I decided to make a feature-length documentary and test the waters by releasing it as a stand-alone programme. Amidst much opposition from well-wishers, I launched the project titled 'Indus Valley to Indira Gandhi' in 1973, and completed it in 1976. Narrating the 5,000 year story of India in four hours, shot in 120 locations across the country, I had burnt my boats in producing this. Some laughed derisively, while some sympathized with my commitment to an impractical idea. Indian film distributors refused to touch the product. Six months later, Warner Bros (Hollywood) took interest and acquired the distribution rights of the film. It proved a run-away hit with the audience - more so in India. The film ran into controversy because of its title. But it had established that without a 'star-cast', a non-fiction film could commercially succeed in a spectacular fashion with audience "buying" tickets to watch a documentary. Jumping four decades, the most recent, rather ambitious project, Mohana and I have been working on for some years, is on a bunch of three products - 'Indian Imprints', an 18-episode documentary serial telecast on the National Network of Doordarshan in 2008; a feature-length documentary titled 'A Different Pilgrimage', completed in 2010 and screened during the Cannes International Film Festival (yet to be released for public exhibition); and 'Tracking Indian Footmarks' - 4 episodes meant for a global audience. All these three titles trace the impact of ancient India on South-east Asia and we have treated them from different perspectives in the three projects. These three constitute a pioneering effort to unravel an aspect of history hardly ever tackled - filmed in hundreds of locations in Indonesia, Thailand, Cambodia, Laos and Vietnam, covering monuments, mythology, philosophy and dance forms. 'Indus Valley to Indira Gandhi' was a 35-mm Eastman colour film. For over two decades, we were working on 35-mm film. I evolved a policy of remaining technologically up-to-date by acquiring state-of-the-art cameras. The International Quorum of Film & Video Producers, Washington DC gives membership only by 'invitation' and not by application. Usually there is only one member per region. In the 1980s, the Quorum made me a member representing South Asia. This helped a great deal to keep myself well informed about

innovations worldwide and introduce them in our own work, adopting technology to local requirements. Thus we switched over to video production very early. Arguably, our company was the first in India to establish Betacam broadcast-quality equipment. We maintained the lead six years ago by being among the first few to be equipped with digital high quality production in DVCPRO 50. I introduced 'Chroma key' facility in my studio long before Doordarshan did. It is a technology by which you create illusions of backgrounds. For one of our Tamil TV serials, the newspapers reviewed that it must have been far too expensive to shoot one whole episode in Paris. In fact, it was all shot within our studio creating the illusion of Paris. We used a combination of virtual reality backgrounds and miniature sets while filming the Tamil classics 'Silappadikaram' and 'Manimegalai' as a Hindi serial titled 'Upasana'. The effect was spectacular but the cost affordable. We began with cell animation 40 years ago for 35-mm film and have come a long way today with 3D animation with computers. They become handy in films related to science and technology.

A S: You have a legacy in film making, your father being a pioneer in the industry. Has this been a burden on you and how have you overcome this?

S K: My father was - and continues to be even after his lifetime - a guiding spirit. It is true that a great man's accomplishments and reputation is as much a burden for a young scion to bear. As a pioneer of South Indian Cinema, he had earned a place for himself which is

Dr. Krishnaswamy anchoring a scene

unique, because he was deeply committed to his ideology - using cinema as a vehicle to propagate the ideals of the freedom struggle, the ideals of women's emancipation and the empowerment of the marginalized. He made a lot of money but lost almost all of it, because of his uncompromising courage of convictions. Hence when I started my company to make non-fiction films in 1964, in financial terms, I started from scratch; but in terms of goodwill and in terms of commitment to ideology, I had inherited a fortune. It was soon possible to overcome the "burden" and enjoy the rich heritage of culture and values I had inherited from my ancestors.

A S: You received higher education in the US and were preparing for a different career. How did you change your trajectory and do you, in retrospect, feel it was worthwhile?

S K: After getting my Bachelor's degree in Physics from Presidency College, Madras (now Chennai) and learning sound engineering privately, I proceeded to New York to study electronics. When I expressed my desire to do this, my father encouraged me whole heartedly and financed my initial education in New York, despite the fact that he was not in the best financial circumstances. Within weeks of my arrival in New York, I discovered that Columbia University was offering a Master's programme in Mass Media with special reference to cinema and television. It attracted me a great deal, while the electronics course that I had joined was too elementary for a Physics graduate. I met the Head of Media at Columbia (Prof. Erik Barnouw, with whom I collaborated in writing a book, two years later) and impressed upon him my interest in film and television by giving him a copy of my Thesis on Expression. That meeting with Prof. Barnouw was a turning point, since he became a major influence on me. I have never looked back.

A S: You have inspired the new generation including your very talented daughters into the art and craft of film making. Would some other means of expressing creativity been more satisfying to you?

S K: The documentary film has remained my first love for half a century. Of course I have made a lot of fiction material as TV serials and also one tele-film based on fiction. I used to write a regular column in the Illustrated Weekly of India in the 1960s. But my pre-occupation as a film maker did not allow me to continue that. My writing since then has been confined to film scripts, but for occasional articles in the print media. I enjoy film making thoroughly; but I feel I should be devoting more time to write for the print medium. I am satisfied with what I do; but there is an element of dissatisfaction, without which one may perhaps stagnate. I want to write a book again. Regarding encouraging another generation, I suppose it has been by default. After all, 46 years is too long a period not to have done that. Yes! I am proud of my daughters, who have blossomed as very gifted and creative film makers - Lata whole-time, and Gita devoting part time in the midst of her other business as co-owner of a Gym.

(I believe that every generation must overtake the previous one in excellence, for the progress of mankind as a whole).

There have been lots of others, who are very successful as cameramen, technicians, etc. One of them who started as my film editing apprentice is now Chairperson of a TV Channel, while another who got his first break with me as a musician is indeed a 'Star music director' of the film industry.

A S: What has been the role of Dr. Mohana in your professional growth and career decisions? Have you been over shadowing her talents? Or has she consciously dwarfed her creativity to help you develop yours?

S K: I admire the sensitivity of your question. Mohana has been a rank holder throughout her education, getting the University gold medal for first rank in B. Sc. After our marriage, she studied M. Sc. and then got her Ph. D. in Biochemistry. She pursued a productive research career at the Central Council for Ayurveda and Siddha. Besides publishing dozens of papers in scientific journals, she was invited to address seminars in USA and China. She won the Hari Om Ashram's Gold Medal for research in Ayurveda. But sometimes, what is intellectually and socially acceptable as National policy, works against individual interest. As part of the socially laudable policy of "affirmative action", the policy of "reservations" worked against her in fulfilling her cherished goal as a scientist as well as climbing. As a scientist, she had offers from abroad including a lucrative one from Denmark. But the mother in her (by then all our three children had arrived) prevailed - to give her best attention to her children and not migrate to Denmark. Also by temperament she is very rooted in India. Scientists working for the government anywhere in India were at that point of time, feeling strangulated by a bureaucratic atmosphere stifling the scientific spirit, and Mohana was no exception. In the meantime, Mohana had pursued documentary film making as a hobby, born out of her own intrinsic interest in the arts - as a Hindustani singer, a Bharatanatyam dancer and as a linguist with proficiency in several languages. Even in the early stages of her involvement in documentary films, she won the IFUW International First Prize at Helsinki, for her film on issues of women's empowerment in Tamil Nadu. Realizing that she was as much a person with talent in humanities as in science, I offered her to join my company which I had started two decades earlier. It may have been a tough decision for her, but she accepted the offer. As a way of acknowledging her leadership qualities and creativity, I requested her to become the Chairperson of our company. From that day onwards I have occupied the second position for the last 25 years. Her contributions to build our company dedicated to communications are immense, understanding the creative needs of our profession and at the same time, taking financially prudent decisions. In the earlier years when I was wearing both the hats of Producer and Director, not only was it a strain, but also there was a financial drain. As Producer of all our work

Producer Dr. Mohana and Director Dr. Krishnaswamy

since then - both documentaries and TV serials, Dr. Mohana has inspired the creativity of all the talents and applied a philosophy of thrift which has resulted in the long term success of our "small is beautiful" enterprise. I sometimes feel guilty that I have interfered in the career of someone who could have blossomed as a great scientist. But the atmosphere to encourage a scientist was absent in the Indian soil that day, and we were personally unwilling to pay the price of separation from each other, by her pursuing a career abroad.

A S: You have been richly decorated for your work in India and abroad. What recognition do you prize the most?

S K: I value and respect all recognitions from all quarters - local, national and international. However, I will bracket three awards as of special significance - the Padmashri is listed on top of them since this is a national recognition from the Head of State. The Life Time Achievement Award conferred by the US International Film and Video Festival, Los Angeles, is another since I happen to be the first Afro-Asian to receive this in 40 years of that festival; and the Honor Summus Award of the Watumull Foundation, Hawaii, to mark the 40th Anniversary of Indian Independence, which they conferred on 40 people from various fields, who contributed to India's development.

A S: You are a voracious reader. What are the books that you are currently reading?

S K: Sometimes I read a book cover to cover. At other times, I read three or four

books at one time often unrelated in subject matter. I am in the second mood right now. I am reading Unconditional Life by Deepak Chopra; besides Steven Levitt and Stephen Dubner's Freakoconomics which takes an unconventional look at the Western Economy. I am also half way through Jeffrey Archer's And Thereby Goes a Tale - his new collection of short stories.

A S: What are your current assignments? Where do you find the energy and ideas for new projects despite being in the industry for so long?

S K: I am presently involved in a few projects while my daughter, Lata, is directing several more. Dr. Mohana is involved in all of them since she is the producer whoever is the director. I am making a compilation of extracts from my father's important, socially relevant films and those which propagated the freedom struggle, with a thread of narration and docudrama re-enacting some aspects of his life - to try and bring out his personality and philosophy as a film maker. This should be ready soon. I am doing the paper work for a long television serial on the life and message of Swami Vivekananda. The active production will commence later this year. Lata is completing an omnibus documentary titled '5,000 Years In 50 Minutes' to introduce the 'idea of India' in less than one hour, from ancient times to the present day. She is also working on a bunch of films for the Ministry of Panchayati Raj which are basically training films for new members and office bearers of Village Panchayaths. Hopefully, we will launch the second season of Arivial Aruvi (Science Trail) which we made for DST last year. You have asked me "where do I find energy and ideas for new projects despite being in the industry for so long?" Let me narrate a story. Photographer William was taking portrait and full figure photographs of the Queen, regularly for half a century. Recently he submitted his portfolio of her new portraits to the Queen. Her Majesty raised her eyebrows and said "Bill! Your photographs are not as nice as they used to be". The photographer humbly replied, "Your Majesty! Perhaps age has caught up with me!". I am 72, and I try to be active - not with the energy levels of youth, but with no regrets.

A S: Do you see the digital and multimedia making the TV obsolete in the near future? How should science journalists and communicators prepare for a digital revolution?

S K: To my way of thinking, no new medium has totally replaced an old one, but has merely captured a segment of the audience. According to Marshall McLuhan, every new medium takes over the ephemeral contents of communication, helping the older medium to mature and cater to a discriminating audience. Much earlier than McLuhan, Wolfgang Riepl (whose theory of media came to be called Reipl's Law) said, "The future merely composts the past....A convergence takes place in the media field, leading to a different way and field of use for the older forms". I believe science communicators should be prepared to hang on to television in addition to adapting themselves to new media. Coming to

thinking of it, new media mainly consist of new distribution avenues, while the production methodology remains largely the same in aesthetic terms.

A S: Since you serve on several juries who, in your opinion, are the most promising science film makers on the national and the international firmament?

S K: It is true that I have served on several juries. It is regrettable that not many science films are entering into competition in the large category of non-fiction films. About 25 years ago, when I was Chairman of the Jury for National Awards For Non-fiction Films, there were only three awards for short films. I found several worthwhile entries which could not be accommodated within those three. I recommended to the government, 18 categories awards for non-fiction films, including science films, agriculture films, biographical films, anthropological films, etc. It was gratifying that my recommendation was implemented from the following year. When I was Chairman of the Jury again seven years later, I had a sense of fulfillment and joy to announce 16 awards in these categories. I am afraid that in the recent festivals over the last three years where I have been on the Jury, I have not come across many films that can be described as science films. This may be because there are now separate festivals for science films and I have not been associated with them.

A S: What positive role can science fiction have on creating excitement and interest in science?

S K: Science fiction is a double-edged sword. When it is written by a well informed scientist with creativity, it is a great boon. Let me give you two examples. In the late 1920s, H.G. Wells' novel on invasion of the Earth by aliens from Mars was produced as a radio play. It resulted in several thousand radio listeners across the cities in America rushing out of their homes in panic thinking that it was Radio News! In a later decade, Arthur Clarke's "Space Odyssey 2001" was a remarkable piece of science fiction. Clark was himself an eminent scientist and so he was able to create science fiction which may one day get transformed to near-reality. He conceived, for instance, the idea of artificial satellites to circle the Earth. Scientists translated this fantasy. However, there is a lot of muck in the guise of science fiction, lacking in scientific possibility. Hence in my opinion, science fiction can create excitement provided it is conceived by people who have a basic understanding of scientific concepts.

A S: What is the message that you would like to give young science communicators?

S K: The tools of communication are evolving with the speed of light. Scientific knowledge is expanding like the universe. It is a challenge for the new generation to be truly well informed on the one hand, and immensely talented in imaginatively using the tools on the other. However, neither knowledge nor skills can become fruitful without deep commitment. The challenge can be met by meditating on the reality hidden behind the phenomena - with the urge to understand Truth and not to be satisfied with mere Facts.

TREES AND RAIN: ANTIBIOTICS OF THE EARTH

Dr. G.S. Chatha

Since time immemorial forests remain as an integral part of human beings. Forests have immense and remarkable value for development of man and other animals living on this earth. Numerous benefits of trees for both the planet's and our health are well-documented. Ecologically and socially, planting of trees provides the following advantages:

- Provide berries, bark, seeds, fruits, leaves, flowers and roots for harvest
- Provide wildlife habitats
- Create diversity in the landscape and preserve wild germplasm
- Help to reduce the impact of climate change
- Provide shelter, windbreaks, shade and noise filters
- Create and provide aesthetic areas where people have access to trees
- Act as phyto-remediators

In the year 1958, India was having 22.8% of total land area under forest cover. But in due course of time, we have cut huge tracts of trees for various purposes including timber, newsprint, packaging and other temporary uses. When we cut forest, we must pay the

cost in the form of drought, water loss, nutrient loss, changed climate, weather, acid rain, erosion of soil, loss of germplasm, extinction of plant and animal species and salted soils. These types of losses cannot be recovered and repaired easily. Can we charge the costs of these losses from any corrupt officials, governments, gangsters and mafias ?

Forest is not only a single body of different cells and functions but it is an assembly of different types of plants as algae, fungi, bryophytes, pteridophytes, gymnosperms, angiosperms and various types of animal species as annelids, insects, mollusks, birds, reptiles, mammals, etc. All the individuals of flora and fauna live in association and dependent upon each other. This inter-relationship between biotic and abiotic factors is termed as ecosystem. An urgent repair and maintenance formula is required to build a balance ecosystem. Trees are the ultimate translators and moderators of incoming energy. Trees build and conserve the soils shielding them from the impact of raindrops and the drying effect of wind and sun shine. While observing the climate change we have to really understand the beneficial effects of trees on our life and Earth. Without trees, we cannot inhabit the Earth and the composition of atmosphere will alter. As a consequence of this, life support systems like oxygen, water and climate will fail.

We should not be deceived by the propaganda which promises that for every tree cut down, a tree is planted. This exchange offer cannot fulfill the properties of original forest as no new re-afforestation can replace an old forest

in energy value. The planting of trees in bulk can assuredly increase local precipitation and moisture contents. It is helpful in reversing the effects of dry land soil salting. An interesting example is the orchid fertilization by wasps which live in forest. They cannot exist without the tree that support it.

Mycorrhizal association of trees

Decidious trees shed leaves from crowns many times during their life span and has built much of the soil. The phenomenon of photosynthesis occur in leaves resulting n the manufacture of food for plants and other animals on Earth. Trees take up Carbon dioxide and release oxygen in air. Trees also die and shed their wastes to the earth. Even single living tree stands in a zone of decomposition, much of it transferred and transported into grasses, bacteria, fungus, insects, birds and mammals. Many of these trees live in association with fungi. These root fungi intercede with water, soil and atmosphere to manufacture cell nutrients for the trees. Tree roots lying below the humus soil is clothed in fungal hyphae and the gels secreted by bacterial colonies. Most of these roots extend over many acres with thousands of kilometres of root hairs like a big mat in the upper surface of soil. The root mat actively absorbs water which is transported up in trees again to transpire to air. In undisturbed rainforests thick deep mosses may carpet the forest floor.

Plants are the main resource of production of crops, vegetables, oil, fibers, fruits and medicine. It is amazing that different types of trees produce different types of minerals and nutrients. *Terminalia chebula, T. bellarica, T. arjuna* are some examples of same genus and there are many more. Animals are the messengers of the trees and trees are the source of nutrition for animals. Life depends upon life. All forces, elements and all life forms are the biomass of the trees.

Effect of winds on trees

Different species of trees show variations of bending and swaying in the forest. Special wood cells are created to bear the tension and compression. Trees on the edge of forest are thick and sturdy. Some leaves twist and reverse showing a white underside to the wind and reflect light energy. In most of the cases, these light-coloured leaves are found only in forest-edge plants and are absent within the forest. More the streamlining over trees along the slopes of hills, air speed increases.

Wind may carry heavy loads of ice, moisture, dust or sand. Pure strand trees of palms, pines and Casuarinas have tough stems and thick bark to withstand blast of strong wind. Even tussock grasses slow down the speed of wind and cause dust loads to settle down. Very fine dusts and industrial aerosols are absorbed by trees from the air within a few hundred meteres in forest. Trees indicate the local wind direction and intensity.

Transpiration effect

Evaporation of water from exposed surface of trees cools air in hot weather

whereas the night condensation of atmospheric water warms the surrounding air. Leaves provide best surface for condensation of moisture because leaf surfaces are cooler than other objects due to the evaporation from stomata during day time. The condensation effect get intensified as air is rising over trees. When air passes over open water it gets cooled in summer. Only trees capture water as they have dehumidifying effect in hot and humid tropical areas.

The composition of the atmosphere is the result of reactive processes and forests may be doing about 80% of the work. Trees modify extremes of heat and humidity to a life-enhancing and tolerable level on the planet Earth. A single giant tree of Til (*Ootea foetens*) may have around 40 acres of laminate leaf surface. Hence the tree have enormously available condensation surface. In the case of tall trees, for example, the giant Redwoods and White Pines, larger the volume of moist air intercepted. greater the precipitation result into rain. All types of trees act as condensers, for examples, *Pinus roxburghii*, *P. wallichiana*, *Quercus incana* and Redwoods. Evergreen trees work all the year round and even deciduous trees catch moisture in winter. The effects of condensation of trees can quickly be destroyed by fragmentation of forests.

Forests are cloud-makers both from water vapour evaporated from the leaves and water transpired. A large evergreen tree such as *Eucalyptus globulus* may pump out 800-1000 gallons of water a day and as a result many thousands of gallons of water are returned to the air to become clouds. Out of 75% percent of water returned to the air by trees, 25% is evaporated from leaf surfaces and 50% transpired. Remaining 25% of rainfall infiltrates the soil and reaches the streams. Forest is continually recycling water to air and land producing 50% of its own rain. These findings keep aside the fallacy that trees and weather are unrelated. Now it is clear that there is an urgent need to save all forest or plant more trees to increase condensation on the hills.

Trees and Snow

Although trees intercept some snow, the effect of shrubs and trees is to entrap snow at the edges of clumps and hold 70-95% of snowfall in shade. Melting of snow is delayed for 2-10 days when compared with open ground. Snow gets trapped within trees but part of it is melted whereas on open ground snow may sublime directly to air. Thus, the beneficial effects of trees on high slopes is not confined to humid regions. When forests are cleared for various purposes, the streams ceases to flow and the lake level falls. Trees are commonly referred to as "hair of the earth" which catches the mists and make the rivers flow. Keeping in view the awareness campaign started in India, now people begin to understand the reasons and beliefs that trees are our essential companions, giving us all the needs of life, and deserve care and respect.

It also depends upon us that how we can make water a scarce or plentiful resource. We can examine ways to increase local precipitation and can increase it on-site. We can cool the air by shade using trees and shrubs, metals and glass. We can cool the air by shade forcing it to higher altitudes or by providing windbreaks and can create suitable condensation surfaces. We can be increase precipitation locally. Small trees intermingled as crosswind belts with tall trees working together in one integrated system. Thus trees act as a strategy for creating more water for local use. They store water for modification of local climatic conditions.

When soil is bare it loses the fertile topsoil. On bare areas and cultivated crops

the impact of droplets carrying away soil is comparatively high than soil covered with forest and grasses. Water runoff carries off nutrients and silt to the nearby streams or rivers or lakes and then into the sea. Clearing of the forests will result in flood and drought. Dams will silt up and the river eventually ceases to flow. After clearing the land, runoff flow increases. Broadly speaking, interception commonly falls between 10-15% of total rainfall. Least interception occurs in thinned and deciduous forests, winter rain, heavy showers and cloudy weather conditions, when it is as little as 10% of rain. Most interception occurs with conditions when it may reach 100% of the total. Stem mosses and bryophytes absorb water many times than their bulk. In the stem bases of palms, many epiphytes and the flanged roots of figs, water is held as aerial ponds, often rich in algae, mosquitoes and fungi soaking up what they need. With the aerial reservoirs are filled, the through fall enters the humus layer of the forest.

Interception of trees

The amount of rainfall caught in the crown is called as 'interception'. It is the most important primary effect of forests on rain. This effect is influenced by Crown thickness, Crown density, Season, Intensity of rain and Evaporation after rain. Deciduous and thin forests with heavy down pour and winter rain show least interception while dense, evergreen trees with light summer rain and sunny days exhibit as high as 100% interception. Imagine that with the water contained in soil humus and root material, the forests represent great lakes of actively-managed and actively recycled water. No other storage system is so beneficial and so much useful for growth.

Forest floor, made up of roots, litter, logs and leaves redirect, slow down and pool the water. The forest soil mantle has every opportunity to act as a major storage capacity. Soil has an immense potential for water storage. Infiltration to this storage along roots and through litter is maximised in forests. The soil has several storage types such as, 1. Retention storage film of water entrapped in soil particles held by surface tension, 2. Interstitial storage as water-filled cavities between soil particles, and 3. Humus storage as swollen mycorrhizal and spongy detritus in soils.

Keeping in view the various utility factors provided and operated by forests, maintenance and repair of already existing forest is needed. Purpose of the forest is to give soil time and means to hold fresh water on land and it should be well understood by every citizen of India. Hence plant as much as trees of same genus and species on the same land, hill, place or region where they were growing earlier, so that same effect of forest can be imposed and felt by nature. If we erase trees from this earth we will be left with only dust.

Dr. G.S. Chatha
Head
Department of Botany and Environmental Studies
Government Shivalik College
Nayanangal -140 126
Punjab
E Mail: drgschatha@gmail.com

SCIENCE OF THE MONTH

N.S. Arun Kumar

APRIL 2011

April 1: An exhibition opening in Chennai on today seeks to explore the science behind cricketing incidents and trigger scientific research on the gentleman's game. Organized by the Indian Science Monitor, the exhibition will showcase great cricket controversies and the science behind them. The exhibition will explain the science behind the effect of ball tampering, preparation of a pitch, the effect of sweat on the ball. Indians are yet to understand the science of cricket. Link: http://www.indusarchaeo.com

April 2: Scientists have unveiled the most accurate map of the Earth's gravity, which shows it to be shaped not like a sphere but a potato. Also known as a geoid, the map is the result of two years of orbital surveys by the European Space Agency Gravity Field and Steady-State Ocean Circulation Explorer satellite. The geoid will also assist scientists in measuring ocean circulation, changes in sea level and the movement of ice sheets, all of which are affected by climate change. Link: http://www.esa.int/SPECIALS/GOCE

April 3: Today is the 38th anniversary of the first public call made from a cell phone. The call was made by Martin Cooper the General Manager of Motorola's Communications Systems Division. The first cell phones were so big that they were described as a "brick" and weighed 2½ pounds. With the explosion of powerful technology, the cell phone is becoming smaller in size and more and more advanced. Link: http://www.google.com/patentsid=nO8tAAAAEBAJ&printsec=abstract&zoom=4#v=onepage&q&f=false

April 4: April is Global Astronomy Month and this past weekend, Saturn is closest to the Earth in its orbit. There is a phenomenon known as the Seeliger Effect, which might actually be a couple of different effects combining to enhance the brightness of Saturn: Since the Earth is smack dab in the middle of the Sun and Saturn, sunlight is coming from directly behind us and directly at Saturn. And there's also the phenomenon called coherent backscattering. Link: http://www.astronomerswithoutborders.org

April 5: New photos from NASA's Messenger spacecraft, the first spacecraft to orbit Mercury show that some of its surfaces are extremely cratered. One area of the far north of Mercury had never been seen by previous spacecraft on mere fly-bys. The new images show scatterings of secondary craters. Messenger has been circling Mercury only since March 17. Mercury and Messenger are about 66 million miles from Earth. Link: http://www.nasa.gov/mission_pages/messenger/main/index.html

April 6: Tropical mangrove trees are better at storing Carbon dioxide than most other forests, and cutting them down unleashes more greenhouse gas than deforestation elsewhere. Mangroves are

so efficient at keeping Carbon dioxide out of the atmosphere that when they are destroyed, they release as much as 10 per cent of all emissions worldwide attributable to deforestation. even though mangroves account for just 0.7 per cent of the tropical forest area. Link: http://www.usda.gov/wps/portal/usda/usdahome

April 7: A team of scientists has developed a new type of atomic clock, which has potential to dramatically improve GPS accuracy and could test the laws of Physics. The highly accurate 'optical lattice' atomic clock, developed by Professor Hidetoshi Katori and his team at the University of Tokyo, could also become a useful tool in developing relativistic geodesy and the search for minerals and hydrocarbons. The research is published in *Nature Photonics.* Link: http://www.nature.com/nphoton/index.html

April 8: Gram-negative bacterial strains with NDM-1 (New Delhi Metallo-beta-lactamase-1) gene, also called the Superbug, have now been detected in drinking water and seepage water samples collected from several sites in New Delhi. Seepage samples were collected from water pools found in streets or rivulets. The findings have been published online in the *Lancet Infectious Diseases* journal. NDM-1 was in the news in August last year by the same journal report. Link: http://www.thelancet.com/laninf-about

April 9: The oldest known full-body impression of a flying insect has been found preserved in 300 million-year-old sandstone. Richard Knecht, of Harvard University's Museum of Comparative Zoology, and colleagues, report their findings in the *Proceedings of the National Academy of Sciences.* The mayfly fossil displaces the previous record-holder from 280-285 million years ago. The fossil was discovered in 2008 by Richard Knecht, then an undergraduate at Tufts University. Link: http://www.pnas.org

April 10: Almost all the currency notes and coins in circulation in the country may be contaminated with bacteria according to a study published in *Current Science.* The researchers said 98% of the currency was contaminated, 96% of the coins and 100% of the currency notes were found to be contaminated with different bacterial species, of which *Staphylococcus aureus*, *Klebsiella* spp. and *Escherichia coli* were considered pathogens, micro-organisms that cause diseases. Link: http://www.ias.ac.in/currsci

April 11: A virus that attacks other viruses has been discovered in a hypersaline lake near Davis Station in Antarctica. The virus is only the third 'Virophage' discovered. The first one, called Sputnik, was discovered in 2008 and the second one, Mavirus, was discovered earlier this year. The new Virophage is called Organic Lake Virophage or OLV, after the lake in which it was found.The research is published in the *Proceedings of the National Academies of Science.* Link: http://www.pnas.org

April 12: It happened 50 years ago today when an air force pilot named Yuri Gagarin became the first human in space. It was the Soviet Union's own giant leap for mankind, humiliating America to race for the moon. The handsome Russian with the big smile became a poster boy for the

communist world, still a national idol 43 years after his death in a jet training accident, and remembered with enormous affection by the last surviving pioneers of the Soviet space program. Link: http://yurigagarin50.org

April 13: A rare bacterium has been discovered in the Lonar crater lake sediments in Buldana district of Maharashtra. This could be first biological evidence of the origin of Lonar crater, microbiologist Dr. Dilip Tambekar of Sant Gagdge Baba University claimed. The bacterium *Bacillus odysseyi* which the scientist discovered was first reported from Mars Odyssey space craft in 2004, he said. U.S. scientists had reported that the bacterium does not have existence on earth. Link: http://www.sgbau.ac.in

April 14: The surprising discovery of a fossil of a sharp-toothed beast that lurked in what is now the western U.S. more than 200 million years ago is filling a gap in dinosaur evolution. The short snout and slanting front teeth of the find, *Daemonosaurus chauliodus* had never before been seen in a Triassic era dinosaur. Hans-Dieter Sues of the Smithsonian's National Museum of Natural History and colleagues report the discovery in the British journal *Proceedings of the Royal Society B*. Link: http://www.mnh.si.edu

April 15: In May the World Health Organization will meet to decide on the destroying of the last Smallpox samples left. There are only two remaining samples left, one at the Centers for Disease Control and Prevention in Atlanta and another at a Russian facility in Siberia. The delay in destruction of the samples has been led by the U.S. and Russia, who argue that they could be used in order to create new treatments in the future. Link: http://www.who.int/mediacentre/factsheets/smallpox/en

April 16: The removal of a massive iceberg from the Mertz glacier in East Antarctica has revealed a huge diversity of new life. The 78-kilometre long iceberg separated from the Mertz glacier after it was rammed by another giant icebėrg. Scientists discovered new species of marine life, including sponges and fish as well as sea stars. Oceanographers from the Australian Antarctic Division also found that the salinity of the ocean around the glacier has decreased. Link: http://www.antarctica.gov.au

April 17: A two-year-old boy from the U.K. has become the only person in the world to be diagnosed with an extra strand in his DNA. Brave Alfie Clamp was born blind and with severe disabilities, which led doctors to carry out various tests. They revealed his seventh chromosome has an extra strand of material which has never been documented anywhere in the world before. Doctors are baffled at his condition, which is so rare it does not have a name. Link: http://www.manchesteronline.co.uk/syndication/services.html

April 18: Scientists at National Dairy Research Institute (NDRI), Karnal and Shere-Kashmir University of Agricultural Sciences and Technology, Kashmir are striving hard for the clone of Pashmina male goat. The serious shortage of fertile Pashmina male goats is on account of the age-old practice to castrate the male goat in order to achieve more natural fibre from the animal.The natural fibre yielded

by the Indian Pashmina goats is considered the finest in the world. Link: http://www.ndri.res.in

April 19: Indian-American doctor Siddhartha Mukherjee's book on cancer has been awarded the Pulitzer prize in the general non-fiction category. Mukherjee's book, The Emperor of All Maladies, recounts the history of the disease and how the war against it is being fought by doctors. The India-born doctor teaches medicine and is a cancer physician at Columbia University Medical Centre. The Pulitzer in the general non-fiction category carries an award of $10,000 (£6,152). Link: http://sidmukherjee.com

April 20: India's PSLV-C16 rocket today successfully launched into orbit the latest remote sensing satellite Resourcesat-2 that would study and help manage natural resources along with two nano satellites. ISRO's workhorse Polar Satellite Launch Vehicle (PSLV) placed in a 'Polar Sun Synchronous Orbit' Resourcesat-2, Youthsat and X-Sat about 18 minutes after it blasted off from the Satish Dhawan Space Centre launch pad in Sriharikota. Link: http://www.isro.org/satellites/irs-p6resourcesat-1.aspx

April 21: In celebration of the 21st anniversary of the Hubble Space Telescope's deployment into space, astronomers pointed Hubble at an especially photogenic group of interacting galaxies called Arp 273. The image, taken by the NASA/ESA Hubble Space Telescope, shows a group of interacting galaxies called Arp 273. These massive stars glow fiercely in ultraviolet light. The interaction was imaged on 17 December 2010, with Hubble's Wide Field Camera 3 (WFC3). Link: http://hubblesite.org

April 22: NASA's Mars Reconnaissance Orbiter has discovered that the atmosphere on Mars changes dramatically as the tilt of the planet's axis varies. Researchers using the orbiter's ground-penetrating radar identified a large, buried deposit of frozen Carbon dioxide, or dry ice, at the Red Planet's south pole. The scientists suspect that much of this Carbon dioxide enters the planet's atmosphere and swells when Mars' tilt increases. The findings are published in the journal *Science*. Link: http://www.sciencedaily.com

April 23: The discovery of four individuals of a new species could shed light on human evolution. The discovery of the new species of early human, *Australopithecus sediba* by South African researchers has caused quite a stir. The researchers said that the hominin shows some surprisingly modern traits and its species may even be an ancestor of our own genus. But most thought it important to compare *Au. sediba* directly with other fossils of early Homo. Link: http://en.wikipedia.org/wiki/Australopithecus_sediba

April 24: Chinese scientists have sequenced the genome of the Crested Ibis (*Nipponia nippon*), an achievement which may aid efforts to protect the endangered bird. By understanding the genetic make-up of the crested ibis, researchers may be able to explain the species' low birth rate and high mortality rate. It was done by researchers from the University and the Beijing Genomics Institute (BGI) in Shenzhen, China's flagship genome center. Link: http://www.genomics.cn/en/index.php

April 25: Kerala government has declared observation of Anti Endosulfan Day today. Kerala Chief Minister, V. S. Achutanandan, has declared that he will be observing fast from 10 am to 5 pm today near the Memorial for Martyrs in Thiruvananthapuram, in support of the state's demand for the union government to exert pressure on the participating nations to enforce a blanket ban on this insecticide, at the Stockholm Convention Meet being held at Geneva from April 25 to 29. Link: http://www.kerala.gov.in

April 26: On April 26, 1986, a botched routine safety test at the control room of Reactor number 4 at the Chernobyl nuclear power facility led to an explosion and a fire that burned for 10 days. The infamous nuclear accident devastated the lives of millions of people in Western Russia, Belarus and the Ukraine. 25 years on, and the nightmare for thousands of people is still frightening. It remains the world's worst nuclear disaster to date. Link: http://chernobyl.undp.org/english

April 27: India is seeking a postponement of the decision on a global ban on Endosulfan to the next meeting of the conference of parties to the Stockholm Convention in 2013, according to observers. In the draft statement, India says that significant adverse health and environmental effects of Endosulfan have not been established. However, the Persistent Organic Pollutants Review Committee of the Convention chose to rely on selective use of data to recommend a ban. Link: http://chm.pops.int/default.aspx

April 28: China will start building a test satellite later this month to detect electromagnetic anomalies in the atmosphere, as part of the country's proposed earthquake monitoring network, and hopes to launch it in 2014. The China Seismo-Electromagnetic Satellite (CSES) has been in development since 2003 and is the first space-based component of the network. It is intended to provide advance warning of earthquakes, such as the one off the coast of Japan last month. Link: http://www.cnsa.gov.cn/n615709/index.html

April 29: The Stockholm Convention today approved the draft proposal for elimination of production and use of Endosulfan and its isomers worldwide, subject to certain exemptions. Exemptions will apply to 22 crops: cotton, jute, coffee, tea, tobacco, cow peas, beans, tomato, eggplant, onion, potato, chillies, apple, mango, gram, pigeon pea, maize, paddy, wheat, groundnuts and mustard. However, the decision will not be binding on India unless specifically ratified by the country. Link: http://chm.pops.int/default.aspx

April 30: When it makes its final launch, NASA's space shuttle Endeavour will carry the AMS-02 (Alpha Magnetic Spectrometer) that will search space for some of the biggest mysteries of Physics- antimatter and dark matter. The AMS particle detector was built and is operated by an international team from 60 institutes in 16 countries. Scientists at CERN were also focusing on more information about antimatter.

N.S. Arun Kumar
Crescent Apartment
Idimuzhikkal
Chelambra P.O.
Malappuram - 673 634
E Mail: yeyenyes@gmail.com
www.aknscience.blogspot.com

INFLUENCE OF STAR'S MOVEMENT ON ITS LIFE

Prof. S.P. Gupta

In order to correctly understand the influence of the movement of a star to its life, the phenomena of the star wind is to be understood. Star wind is a consequence of the star's anti-gravitational rebuffing of the evaporated photospheric substance. Temperature of those molecules rises with acceleration - that is what we know from the molecular kinetic gas theory, higher speed implies higher temperature. But, molecular kinetic theory of gas has not explained the true reason for that. How can temperature cause speed? How can speed cause temperature?

Basic necessity is the existence of the gravitational field. Everything that the molecular kinetic theory has described is happening in the gravitational field of the Earth. Star's wind is born and it exists in the gravitational field of a star. Body temperature is the factor that changes the quantity and the quality of the body's mass. Change in the speed of a body implies the existence of the acceleration. Acceleration implies action of a power.

In the gravitational field of a body, gravitational force attracts all the bodies with the attractive mass, and the anti-gravitational force rebuffs all the bodies with the negative mass. Therefore, the temperature of a body, which is in a gravitational field of another body, decides whether that body will be gravitationally attracted or anti-gravitationally rebuffed.

Since the molecules of the evaporated photospheric substance have negative mass, they are rebuffed from the star by the anti-gravitational force and thus, their speed rises. With the rise in the speed, their temperature rises, and thus, their mass negativity quantitatively rise, and an even larger anti-gravitational force of rebuffing affects them. That is how it comes to larger and larger speeds and higher and higher temperatures of the star wind with the alienation from the star's surface. The reversed dependence of the anti-gravitational force of the square distance, of course, leads, at one point, in reaching the maximal speed and the maximal temperature, after which, a gradual fall of both the temperature and the speed follows.

Hence, temperature, through the anti-gravitational power, enhances the speed in which the molecules of the photospheric vapour alienate themselves from the star. This answers the question on how the temperature enhances the speed.

The mechanism of how speed enhances the temperature can be explained thus: The speed is not the factor that enhances the temperature; the factor is change in the speed or acceleration that is the consequence of the action of the anti-gravitational power. What is really happening during the action of a power to a body? This is an utterly fundamental question in Physics and the answer to it must be completely understandable and logical.

When a power affects a body, it exerts activity upon it. Activity that a force exerts upon a body is divided in three parts. First, and the most interesting part for us, is used for overpowering the body inertia. Second part is used for the change (enhancement) of the kinetic energy of the body, because its speed had changed (enhanced). Third part is used for the change of the potential energy, because its position in the power field is changed.

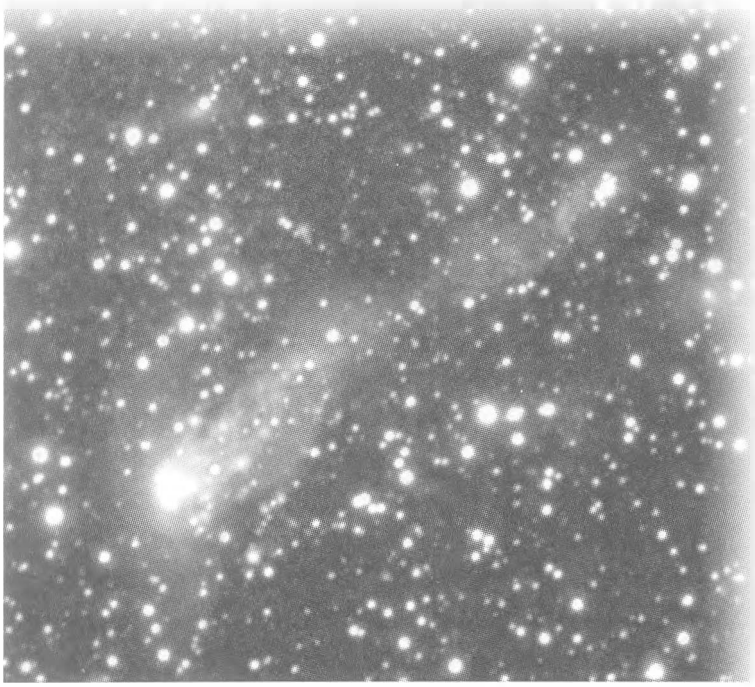
What is inertia? Physics says that it is a feature of a body to resist the change in the state of its movement. It is logical that the feature of a body lies in a certain physical reason. If a force affects a body, and a body resists the effect of that force, it logically means that there is a force of an inverse square action. The inertia is a consequence of the interaction of the physical body with the physical space. There is friction between the physical body and the physical space. Where there is friction, there is heating, that is, change in temperature. Therefore, the first part of the action, that a power is exerting on a body, is spent on the overpowering the inertia, that is the friction between the body and space, which causes the change of the inner energy of both the body and the space. Here we are interested in the change of the inner energy of the body, which means, in the final outcome, the temperature of a body rises on the account of the part of the action of the power over the body that over powers the energy. The law of conservation of energy is now satisfied.

So, anti-gravitational power that exerts action over the molecules of the evaporated photospheric substance, uses one part of that action on rising the temperature of those molecules due the friction between the molecules and the space. That is the essence of the answer how a change in speed causes the change in the temperature.

When the speed of a body is unchangeable, both for its direction and its intensity, we say that it is inertial movement. For inertial movement there is a rule that the speed is constant, and so the temperature too is constant. But nowhere in space do we have inertial movement. Everything is spinning around itself and something else.

The non-inertial movement implies rotation because the direction of speed is being changed there, although the intensity remains the same. Rotation is a consequence of the existence of the centripetal force, and gravitation plays its role in the universe. Therefore, all the bodies that spin around themselves or around another body are in permanent friction with the physical space and in permanent process of heating. All that we have just said applies to stars, as celestial bodies, too.

Spinning of a star around its axis, as well as around the mass centre of a double or a multiple system, or the centre of a galaxy, causes heating of the star. The existing astrophysics does not know this!



Spinning of a star around its axis, as well as around the mass centre of a double or a multiple system, or the centre of a galaxy, causes heating of the star. The existing astrophysics does not know this!

New astrophysics has to include this mechanism of rise of the star's

temperature. If we name the factors that determine the temperature of a star it looks like this:

1. **Gravitational shrinkage of a star:** It is determined by the amount of the substance and its temperature. That overall mass shrinks the star gravitationally until there is a balance with the force of the anti-gravitational rebuffing whose outcome is in the central hollow of the very star. The larger the attractive mass of a star, the larger the shrinkage, along with the pressure and the density and the temperature of a star. It means that the 'vaporization' of a star through the star wind is stronger, that is, the star loses its substance quicker. When a considerable substance loss leads to the weakening of the gravitational shrinkage, star's wind will die away and on the whole, the star will loose its glow (luminosity). Hence, it is clear that the star's higher temperature leads to stronger glow (luminosity), but a shorter life span. Of course, the larger the starting amount of the star's substance, the longer is its life and glow.

2. **Star's radius and the angular speed of the spinning around its own axis:** The larger the amount of the substance a star contains, the longer its radius. That is, a larger radius causes greater gravitational shrinkage, higher temperature, and so on. The same angular rotation speed around its own axis for two stars of different radii will cause larger heating for the star with a longer radius. But that heating, due to the spinning around its axis, can provide greater glow (luminosity) to a star, if it spins faster, than another star that spins slowly, while they are of the same size that is the same substance amount. Along with that, the star's life span will be different, too. Differential rotation of the sole stars is also a consequence of that friction of the star and the space.

3. **Distance from the mass centre system and the speed of spinning around it:** Stars usually appear in binary or multiple systems. This means that a star that spins faster around the mass center of its system will have higher temperature than the same star that spins slowly around the mass center of a similar system. Lesser distance from the mass center means quicker rotation of the whole system, and larger heating of the star under the influence of the star wind of the other members of the system.

4. **Distance from the galaxy centre:** We have seen that the galactic nucleus rotates as a solid body, and at a larger speed than its arms, which leads to the spiral look of galaxies. The farther the star from the center of the galaxy, the lower its rotation speed around it, and its heating is therefore lower. Concentration of the stars rises with approaching to the galactic centre, which means that the galactic wind is getting stronger, that it heats the stars that are closer more than those that are farther.

Hence, a star closer to the galactic centre will have higher temperature and higher glow (luminosity) than the same star that is located farther than the galactic centre. Intensive galactic wind in its nucleus that originates from the star winds of the galactic nucleus is a factor that with its anti-gravitational nature expands the galaxy and separates the stars between themselves.

5. **Galaxy movement in a cluster and a super cluster of galaxies:** A galaxy spins around the galactic axis, but it also moves at great speed around the centre of a cluster of galaxies, and a cluster of galaxies around the centre of a super cluster of galaxies. Superposition of those movements with the aforementioned star movement (around its axis, around the system centre and the galaxy centre) heats the star additionally because of the great speeds the sole galaxies move at.

6. **Star's chemical structure:** Since not all the stars have the same chemical structure, some of them are made of heavier and some of lighter substance. Heavier substance causes greater gravitational shrinkage and during its movement it accomplishes greater friction with the space, and it logically, implies that heavier stars have higher temperature, higher luminosity and more intensive wind than the 'lighter' stars of the same size and the same conditions of movement. The substance of the 'heavier' stars is disintegrated in a different manner in the star wind than the substance of the 'lighter' stars, so according to the chemical structure of a star's wind we can conclude about the 'weight' of that star, that is about its chemical structure.

Numerous factors effect the maintaining of a star's temperature, thus effecting the length of its life. Such mechanisms provide stars with a much, much longer life that that anticipated by the existing astrophysics.

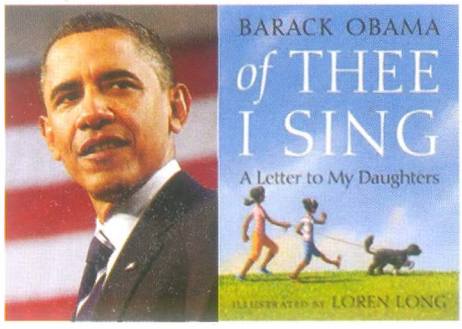
7. **Intensity of the star's wind:** When all the other factors do theirs and get a star to a certain temperature, then the arisen wind continues to additionally heat the star, because a part of the heat of the star atmosphere falls to its photosphere and heats it up even more.

So we see that numerous factors effect the maintaining of a star's temperature, thus effecting the length of its life. Such mechanisms provide stars with a much, much longer life than that anticipated by the existing astrophysics.

Prof. S.P. Gupta
Associate Professor and Head
Department of Physics
University College
Kurukshetra University
Kurukshetra - 136 119
Haryana
E Mail: spkuk@rediffmail.com

BOOK OF THE MONTH

Of Thee I Sing: A Letter to My Daughters



Title	Of Thee I Sing: A Letter to My Daughters
Author	Barack Obama
Publisher	Knopf Books
Pages	40
Price	$26
ISBN	978-0375835278

On sale for about a week, "Of Thee I Sing," President Obama's children's picture book, an ode to 13 inspirational Americans written as a letter to his daughters, Malia and Sasha, is already on the best-seller lists in the world.

"Of Thee I Sing: A Letter to My Daughters" is a tribute to 13 groundbreaking Americans, from the first President, George Washington, to baseball great Jackie Robinson to artist Georgia O'Keeffe. It was released on 16 November, 2010 by Alfred A. Knopf Books for Young Readers, an imprint of Random House Children's Books.

Obama is not the first President to write for young people. Jimmy Carter's "The Little Baby Snoogle-Fleejer" was published in 1995, more than a decade after he left office. More in line with Obama's effort, Theodore Roosevelt collaborated with Henry Cabot Lodge on "Hero Tales from American History," released in 1895, before Roosevelt was President.

Obama's book is illustrated by Loren Long, whose many credits include Watty Piper's classic "The Little Engine That Could," Randall de Seve's "Toy Boat" and Madonna's "Mr. Peabody's Apples." Long wrote and illustrated the children's stories "Otis" and "Drummer Boy." His cover design for "Of Thee I Sing" is a sunny impression of presidential daughters Sasha and Malia Obama walking their dog, Bo, along a grassy field.

Obama's 40-page book will have a first printing of 500,000 copies and a list price of $17.99. Both of Obama's previous works, the memoir "Dreams From My Father" and the policy book "The Audacity of Hope," are million sellers published by Crown, a Division of Random House Inc.

While Mr. Obama may be the first sitting President to publish a children's book, other White House occupants have made their own contributions to children's literature.Long before she was Secretary of State, Hillary Rodham Clinton wrote "Dear Socks, Dear Buddy," a compilation of letters to the first pets of the Clinton administration.

While children's books are generally safe territory, politically speaking, Mr. Obama attracted criticism from the right for his inclusion of Sitting Bull as one of 13 "groundbreaking Americans" honored in the book. A headline on Fox Nation, a Fox News online conservative forum, read, "Obama Praises Indian Chief Who Defeated U.S. General."

Doug Wead, a former Bush family adviser and the author of "All the Presidents' Children: Triumph and Tragedy in the Lives of America's First Families," said in an e-mail that he wondered how Mr. Obama had managed to find time to write the book.

As for a possible motivation Mr. Obama might have had for writing it, Mr. Wead suggested, "He is wanting to build the dreams of young ladies."

Review Text Courtesy: http://mediadecoder.blogs.nytimes.com, http://abcnews.go.com

Link: http://my.barackobama.com

N.S. Arun Kumar
Crescent Apartments
Idimuzhikkal
Chelambra P.O.
Malappuram – 673 634
E Mail:yeyenyes@gmail.com
www.aknscience.blogspot.com

SCIENCE INDIA

Registered No. KL/EKM/691/2009-2011
June 2011 Vol 14. No. 6

Attention Subscribers !!

SUBSCRIPTION RATE

INDIVIDUALS

Single Issue:	Rs. 20
Annual Subscription:	Rs. 200
Three year Subscription	Rs. 500

INSTITUTIONS

Annual Subscription (Schools):	Rs. 600
Three year Subscription (Shcools) :	Rs. 1500
Annual Subscription (Colleges, Other Institutes etc.):	Rs. 1000
Three year Subscription (Colleges, Other Institutes etc.):	Rs. 2500

FOREIGN COUNTRIES

Single Issue:	U.S. $ 10
Annual Subscription:	U.S. $ 80
Three year Subscription :	U.S. $ 200

For subscriptions, please fill the form below and mail to Science India.

WE ACCEPT ONLY DD/MONEY ORDER

Mail to:

SCIENCE INDIA
Sastra Bhavan, B-4, 4th Floor, Mather Square
Town Railway Station Road, Cochin - 682 018
Ph : 0484 - 2393242, 2393256 Fax:2393256
E-mail: scienceindia2010@gmail.com
www.scienceindia.in

I/We wish to subscribe Science India for one year/..... years. The subscription fee of Rs..... is sent herewith as demand draft (payable at Ernakulam), drawn in favour of Science India

DD/MO (in favour of Science India, Ernakulam)

Date..... Number..... Bank.....

Name.....

Mailing Address.....

.....

.....

.....*Pin*.....

Telephone..... *E-mail*.....

Date: *Signature*